



cinefex

... the journal of cinematic illusions

publisher
Don Shay
editor
Jody Duncan
associate editor
Estelle Shay
senior writers
Janine Pourroy
Mark Cotta Vaz
advertising director
Bill Lindsay
advertising representative
Janice Hubbard Lindsay
circulation manager
Margie Duncan

PRINTED IN USA

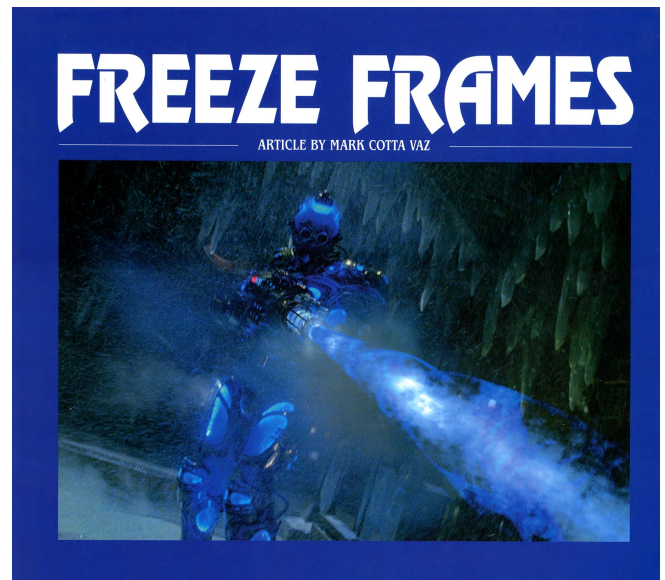
CINEFEX 71 - September 1997. Published quarterly at
P.O. Box 20027, Riverside, CA 92516 - (909) 781-1917.
Subscriptions (U.S.): four issues - \$28; eight issues -
\$48; twelve issues - \$66. Printed by Valley Printers,
Inc., Riverside, CA. Contents copyright © 1997 by Don
Shay. All rights reserved. Reproduction in whole or in
part without written permission is prohibited.

Freeze Frames	15
For <i>Batman & Robin</i> - the fourth feature in the Batman series and the second for director Joel Schumacher - visual effects supervisor John Dykstra drew upon the specialties of several effects houses to produce a series-high four hundred effects shots. <i>Article by Mark Cotta Vaz.</i>	
Toasting the Coast	57
Tasked with unleashing the ultimate scourge on Los Angeles for the Mick Jackson film, <i>Volcano</i> , visual effects supervisor Mat Beck oversaw the creation of volcano and lava effects achieved via practical, miniature and digital means. <i>Article by Rita Street.</i>	
With a Little Help From Our Friends	90
To bring the comic book sensation <i>Spawn</i> to the screen, a trio of young upstarts from Industrial Light & Magic donned production hats and engaged in guerrilla filmmaking in the digital realm to create a lavish effects film on a slender budget. <i>Article by Jody Duncan.</i>	
Close Contact	114
With effects ranging from earthbound to cosmic, <i>Contact</i> marked the seventh collaboration between director Robert Zemeckis and visual effects supervisor Ken Ralston, now head of Sony Pictures Imageworks. <i>Article by Kevin H. Martin.</i>	
Speed 2: Cruising Speed	141
John Chambers: Maestro of Makeup	159

COVER - The demoniacal Malebolgia raises hell in *Spawn*.

FREEZE FRAMES

ARTICLE BY MARK COTTA VAZ



It was eight summers ago that a pair of street punks, resting on a rooftop with some ill-gotten gains, were roused by a menacing figure garbed in black cape and cowl. One of the two had already been itchy with fear about a human vampire bat, said to be haunting the underworld; and suddenly, here was the thing itself, impervious to seemingly dead-on gunfire, punishing him with a brutal sidekick before grabbing his companion and dangling him over the building's precipice. To the terrified question – “What are you?” – the cloaked figure answered with a defiant hiss, “I’m *Batman*.”

Batman starring Michael Keaton as the man-behind-the-mask, not only brought to big-screen fulfillment the venerable DC Comics’ crimefighter, its success also ensured a succession of sequels – *Batman Returns*, followed by *Batman Forever*. Star acting ensembles, breakthrough visual effects and ambitious production designs exalted the *Batman* legend into something far beyond its beginnings as a ten-cent pulp comic, and made the *Batman* series the apotheosis of the blockbuster franchise film. With *Batman & Robin* – the latest installment in the saga, actor George Clooney would don the Batsuit for the first time, joining Wayne Manor’s returning occupants Robin (Chris O’Donnell) and Alfred (Michael Gough). Giving our heroes a hand would be a new addition to the crime-fighting crusade, Batgirl (Alicia Silverstone). The requisite super villains would be along to bedevil the Caped Crusaders: the cold-blooded Dr. Victor Fries, aka Mr. Freeze (Arnold Schwarzenegger), and the intoxicating Poison Ivy (Uma Thurman), along with Ivy’s steroid-stoked flunky Bane (Jeep Swenson).

Like its immediate predecessor, *Batman & Robin* was directed by Joel Schumacher, who had taken over the helm of the *Batman* franchise from Tim Burton, originator of the first two entries. While Burton’s love of funky effects and the hilariously horrific found expression in a darkly gothic Gotham and twisted super villains, Schumacher brought to the proceedings a stylish elan that recast Gotham as a city of bright lights and attempted to ‘make the comic book’ on the big screen. To tackle the latest movie, Schumacher assembled most of his *Batman Forever* principals, including

production designer Barbara Ling and director of photography Stephen Goldblatt – as well as Oscar-winner John Dykstra, who would again head up the visual effects effort. Co-supervisors were Andrew Adamson, Eric Durst and David Stump, overseeing the computer graphics assignment, the miniatures work and technical photography, respectively. Also reprising their roles were a number of vendors: Pacific Data Images, which again created a synthetic, computer generated *Batman*; TFX, the firm responsible for the full-scale Batmobile and other fantastic vehicles; and Rick Baker, who had created the split-featured Two-Face makeup for *Batman Forever*. For the new film, Baker would create ice-encased victims of Mr. Freeze's rays, with additional freeze victims provided by Alterian Studios. A newcomer to *Batman*'s world would be Buf Compagnie, the French effects company that had caused a stir with its fantasy effects for *The City of Lost Children*, which would be adding key CG effects ranging from Poison Ivy's 'love dust' to a powerful beam Mr. Freeze uses to freeze Gotham itself.

As with all the previous *Batman* productions, the new film would boast an intensive model and miniatures effort, with miniature supervisor Ian Hunter, of Hunter/Gratzner Industries, overseeing the construction of the Gotham cityscape, as well as miniature versions of the vehicles. Shooting the models was the so-called Iceman unit, a reuniting of the crew that had worked together on *Batman Forever*, including a Warner Brothers contingent led by Durst and producer Kurt Williams. Another unit from Chandler Group, supervised by Don Baker, was brought in for additional model photography support. In a new twist on miniatures work, Warner Digital Studios, the studio's in-house effects division, would extend the miniatures to outrageous heights via computer graphics.

While the succession of actors portraying *Batman* has always been grist for the publicity mill, one of the major draws of a *Batman* movie are its colorful villains. With Freeze and Ivy, the director had lined up a pair of evil-doers that were polar opposites in style, but united in opposition to the Dark Knight. "In a *Batman* movie," observed Schumacher, "the villains set a great deal of the tone. With Mr. Freeze we had a villain who could freeze anything; so his world was a winter wonderland of freezing rays, ice vehicles, ice hockey and extreme skating. In contrast. Poison Ivy lives in a rarefied atmosphere of voluptuous flowers where everything is created to snare people into her trap, where she will kiss and kill them because she has poison on her lips. Those were all wonderful elements that could be taken to the extreme because of the comic-book quality of the *Batman* movies."

Once again, it was the *Batman* comics themselves, and the long lineage of Dark Knight artists, that were Schumacher's font of inspiration for the look of the film. *Batman* creator Bob Kane had set the tone with his hard-boiled landscape of perpetual night, full moons and long shadows, while a legion of comics artists through the decades further developed and interpreted the character. "I didn't copy those artists' work so much as immerse myself in hundreds of *Batman* comics before starting the movie," Schumacher said. "What I tried to do was give the audience the visuals and framing you'd expect from a great comic. My only goal was to make a living comic book."

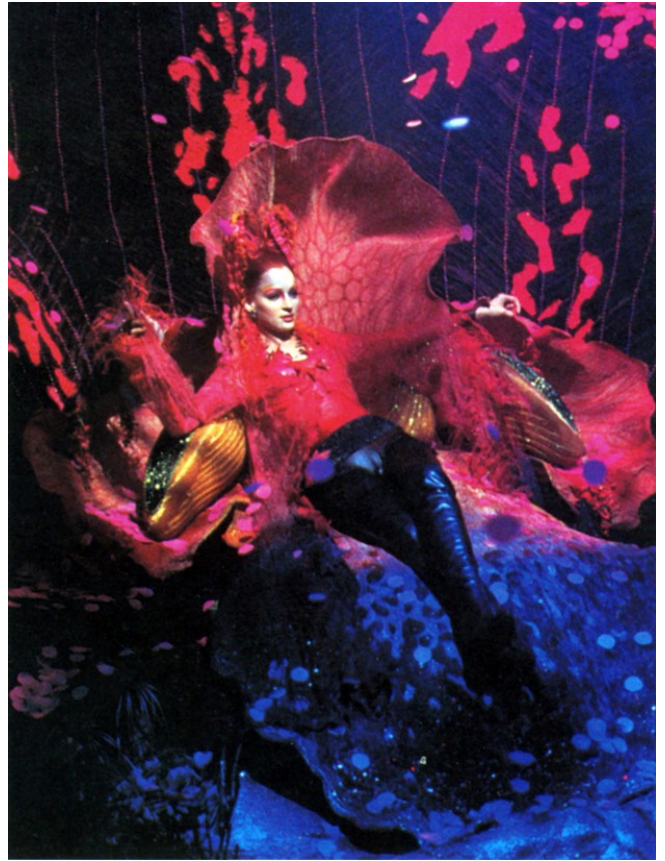
Therein lay the great challenge for both the production and the visual effects teams – to emulate through film images the fantastic world created in a static medium with the scratch of a pencil and the touch of a brushstroke. "We had to capture the dynamics and force of the two-dimensional comics page and interpret it to the big screen," explained John Dykstra. "That is really hard, because a single comics panel is open to a reader's interpretation of what happens before and after, in terms of motion. We had to essentially add all the frames that precede and come after that single panel."

In its pure comic book spirit, *Batman & Robin* was far more ambitious than any of the previous *Batman* motion pictures. In addition to expanding the scope of *Batman*'s world – including a bigger Batcave and a Gotham that would rise thousands of feet into the air – the film would feature classical comic book scenarios: Mr. Freeze's patented freeze ray capabilities would intensify to the point that the entire metropolis would be put on ice; the Dynamic Duo would chase Freeze during a free-falling skyboarding sequence, and later conduct a highspeed pursuit over one of the giant sculptures that curiously dominate Gotham's skyline. Such comic book dynamics were made possible by accelerating digital capabilities. "Improvements in the area of electronic imaging contributed to our being able to present a viable image that had as much excitement as the comic book," John Dykstra declared. "There's an embarrassment of riches these days, which is great because it forces you to come up with new ideas. But we were still very careful and clever about the use of computer generated imagery in this movie."

With more than 400 effects shots – compared to some 250 on *Batman Forever* – *Batman & Robin* fused a variety of methodologies, including miniatures, greenscreen photography and computer animation. Further, to extend the sprawling metropolis of Gotham City, techniques ranging from old-fashioned translight backings to digitally painted vistas were utilized. But the real breakthrough was the melding of physical miniature buildings and computer generated 'city extensions' – as the production called them – to create skyscrapers rising thousands of feet.



In a scene created by Pacific Data Images for the Joel Schumacher film. Batman & Robin, digital stunt performers representing the Dynamic Duo skyboard through the night skies.



Principal villains for the fourth Batman outing were the seductive Poison Ivy (Uma Thurman) – lounging on an orchid bed built by Alterian Studios – and the chilling Mr. Freeze (Arnold Schwarzenegger).

Gotham had been evolving ever since the first film. Although the late Anton Furst, production designer on *Batman*, had also conceived the city with an eye to the vertical – Gotham Cathedral, for example, was envisioned as being more than a thousand feet tall – its scale could be alluded to only with miniatures and 2-D matte paintings. For *Batman Returns*, production designer Bo Welch retained the concept of skyscrapers towering hundreds of stories in the air, designing and building structures that conveyed a decaying Gotham. When Schumacher took over the series, Barbara Ling's urban renewal effort included a bright comic book color scheme, a more cosmopolitan mood – complete with distinctive neighborhoods and giant statuary decorating the skyscraper fronts – and the most vertical Gotham yet.

As in previous depictions, the Gotham of *Batman & Robin* would suggest neither an identifiable past nor an imagined future, but rather a city out of time, with melded – often competing – architectural visions. Ling characterized the Gotham City aesthetic of both of her *Batman* productions as a melting pot of Gothic, Russian Expressionist and Constructivism, with a little bit of Nouveau thrown

into the mix. The breakthrough for the fourth film was not one of style then, but of execution, with Gotham City being realized through a combination of full-scale sets, motion control model photography and computer generated structures. "On the last film," Ling observed, "we did not have a time frame that would allow us to build the scale of miniatures we had dreamed of. But this time, the scale of Gotham is really evident. Our exterior views are much larger because we were able to combine miniatures, CGI and live elements."

"We extended the city in real scale," explained visual effects art director James Hegedus, "with buildings that reached 3000 feet or higher. To get that feeling of great height, we would have thirty feet of twenty-fourth-scale miniatures – which, in real scale would translate to 750 feet – to represent the upper portion of the buildings. Then we would add CGI extensions to the bases of those buildings that would continue them another 1000 to 1500 feet, down to street level."



Principal villains for the fourth Batman outing were the seductive Poison Ivy (Uma Thurman) – lounging on an orchid bed built by Alterian Studios – and the chilling Mr. Freeze (Arnold Schwarzenegger).

Since it would have been prohibitive to create 3000-foot-tall buildings through either computer or physical models alone, the combining of miniatures with CG extensions proved a perfect solution to the dilemma of stretching and extending the skyline, enabling the visual effects team to reap the benefits of both approaches. “With physical miniatures and model photography,” commented Dykstra, “you get a built-in level of texture and resolution – all the fine details that are impractical to try and get in the computer. Yet, there are some interesting things you can do in a computer that aren’t practical to do with a miniature, especially in terms of lighting.”

While *Batman Forever* had featured twelve to sixteen hero model buildings, *Batman & Robin* would have nearly thirty-five, including refurbished models from the previous production and an additional twenty or so new ones. Early on, with script in hand, Ian Hunter had worked with John Dykstra to divide the Gotham shots into those best accomplished by either models, matte paintings or CG. Ironically, while at the now-defunct Stetson Visual Services, Hunter had been the lead modelmaker on *The Hudsucker Proxy*, whose New York skyscraper models wound up being reemployed in both of the Schumacher *Batman* productions. For the current film, Hunter’s unit repaired wear and tear on the Hudsucker models, and lead painter Suzi Miscovich guided the repainting of them in the bold color schemes envisioned by Ling. Filigreed details created in etched brass provided railings, fire escapes, antennas and other three-dimensional touches to dress out both the old and new buildings and tie them all together.

The production’s Iceman miniatures unit operated out of the Syncro Hangar at Van Nuys Airport. Adjacent to the hangar was a mill area that Hunter and a crew of sixty-four transformed into a model shop. Since the Syncro stage was only thirty-five feet tall, Hunter had to blow the whistle on an early request for sixty-foot-tall buildings, settling instead for ones ranging from sixteen to thirty-one feet. With the Iceman shooting schedule predicated on the availability of the buildings, Hunter and crew provided models as quickly as possible. “I tried to standardize our production method,” Hunter said, “so it became something like a *World War II* aircraft factory, where they’d turn out plane after plane. We set up in March of ‘96, and the model shop was running by April. I organized it so that materials would come in one door where there was a lumber mill and a mold making shop that made all the parts. Those were then pushed over to the modelmakers, who would add all the details. Then on to the spray booth where the model would be painted. Finally, we would roll the completed building out a roll-up door that was adjacent to the Syncro stage.”

The construction of the models themselves was also a streamlined, efficient process. “We made differently shaped buildings using a common skeleton,” related Hunter, “rather than creating a steel frame that was completely different from building to building. We had a standardized, sixteen-inch-square steel framework running up the center and outside of the buildings. Then we would cut our bulkheads to match the profile of the building and skin it. The steel frames were in six-foot sections, so we could break the buildings apart. That allowed the Iceman unit to add or subtract



An all-new Batmobile and the Redbird motorcycle were among the custom vehicles created for the production by TFX.

building sections so you wouldn't see the same view every time you shot a model. The sections could be stacked on each other, with a standard bolt pattern on each section to bolt them together. We had to make the buildings in sections, anyway, because the stage door was only eighteen feet tall."

Another process that expedited the model build was 'pin-routing.' "Pin-routing is similar to laser-cutting," explained Hunter, "but instead of using a laser, the cutting is done by a spinning, sharp bit driven by a computer. We used it to cut out some of the building walls, such as the so-called Woolworth Building that was about twenty-nine feet tall. We had everything from brick to window openings cut out with this pin router by the Warner sign department. So when the Woolworth model arrived at the Syncro Hangar, it was basically a big kit that we just had to put on a frame and screw together."

Even before the Iceman unit began shooting, Lance Hammer of the art department had begun measuring models as the first step in creating digital animatics that would allow the production to plan complex shot compositions and their execution. Hammer, an experienced urban designer who had helped construct *Batman Forever's* CG Gotham cityscape, also measured the Syncro crew's motion control camera and rig, ensuring that the virtual animatics camera would be a perfect simulation of the stage version.

In the past, previsualization was a trial-and-error affair, sometimes nothing more than a crude video run-through of a model mockup. The ability to create 3-D wire-frame animatics by running a virtual camera through possible model configurations – a relatively recent technology – was a mandatory tool for *Batman & Robin* due to the show's hundreds of multiple element shots. Through those animatics, shots were worked out to the finest detail. Stage camera movement and speed were determined, as were what models would be required for each particular shot and the blend line for the CG city extension work. "Using the animatics," noted Andrew Adamson, "we could cut together most of the difficult sequences before we even started filming – which was important because sometimes we were doing the miniature photography before the foregrounds that would go with those miniatures. Since the geometry of our animatics camera was the same as the hard camera, we could work out a shot in advance without spending days with thirty different people on stage, wheeling around huge miniatures. We spent a lot more time in front of a computer and a lot less time shooting."

For the Iceman crew, faced with the challenge of some 120 complex miniature effects shots, the previsualizations were a godsend. "The animatics allowed the model work to be more fine-tuned than it was on *Batman Forever*," Kurt Williams observed. "They provided us with a blueprint for how to configure our models on stage. Also, the final animatics camera moves were put into a file that we could plug directly into our Kuper motion control camera on the set."

The animatics also locked in a precise final configuration for the models, helping the Syncro crew to determine where to concentrate detailing. "We added layers of detail to the miniatures," said Williams, "such as signs and billboards, an elevated subway train and miniature moving cars on two- and four-lane roadways, powered by stepper motors synchronized with the Kuper system so we could do multiple passes. Since our building models were going to be extended downwards in CGI, the lighting on both had to match; and the animatics helped us synchronize the lighting. To

create a matte line, we painted fluorescent orange around the bottoms of the model buildings. From there, the buildings could be extended down another thousand stories or more in CGI.”

Traditionally, the transition from a live-action building to a miniature extension has been accomplished with a wipe – masked by a conveniently placed girder, ledge or some other piece of structural edifice. The Gotham building extensions for *Batman & Robin*, however, had to blend seamlessly into one integrated structure. And although Warner Digital could utilize the Syncro motion control data in matching the camera moves and rendering the city extensions, the precise positioning required to match the plates necessitated a little something extra. “We didn’t have to do highly detailed CG city models,” related Wendy Rogers, Warner Digital’s visual effects supervisor for the production, “but there was a certain level of detail required to make the dimensions accurate. We had the site plan telling us where the Syncro team was going to position their miniatures; but in the real world they weren’t going to measure something to hundredths of an inch—which was the level of accuracy we needed in the CGI world in order to line up our extensions exactly with the model photography.”

To extract the required data, light-emitting diodes, which could be measured by a theodolite surveying device to determine accurate measurements, were placed on the miniature set. “Tracking and matching the camera move was a major issue,” Adamson noted, “because on the city extensions everything had to work in perspective. In the past, people would mark data on set using tennis balls or lights. The LEDs, however, would blink at one-thousandth of a second, which was a high-enough frequency that we could get a nice crisp dot, not a motion-blurred light.” The city extension work was also facilitated by the use of photogrammetry. “Photogrammetry is a technique in which we take two or more views of an object in 2-D space to create 3-D geometry. Using LEDs to determine camera positions, we can conclude where the object is in the computer, and then apply the 3-D geometry that allows us to do camera moves with all the parallax shifts you can’t get on a 2-D image.”



To represent Gotham City, about three dozen large-scale buildings were refurbished or built from scratch by Hunter/Gratzner Industries, then extended digitally by Warner Digital Studios.

“For the miniatures photography,” Eric Durst elaborated, “we’d do a white light pass to allow the 3-D animators to see exactly where in normal light the miniatures were located, and where the floor was. Sometimes we’d just put a grid on the floor, and they could take that information into the computer, place their 3-D models on top, and match the movement and variables involved.” Grids were photographed for each photographic lens. “The computer sees a perfect universe; but lenses are hand-made glass and always distort around the edges. So we had to spend a good amount of time in the computer, figuring out the match between the distortions and the lenses. We could just lay the grid showing the distortions over the perfect grid in the computer, which would show exactly what distortions needed to be added in CGI.”

While Gotham is the great stage upon which *Batman’s* heroes and villains always clash, the combatants have also needed personal lairs in which to lick their wounds or plot a fresh assault. For the villains, this has invariably meant some abandoned facility in the decaying inner city, or some spooky old house on the outskirts of town. Serving as Poison Ivy’s sanctuary was a Turkish bathhouse. “Ivy transforms the place into a frightening Garden of Eden,” said Barbara Ling, “casting plant seeds that grow and fill her place in seconds. For closeups, we used puppeteered plant effects; but for shots of the plants taking over the whole bathhouse, we relied on CGI, which provided a very exciting growth effect.”

The task of creating Ivy’s super plant growth was assigned to Buf Compagnie. The feat involved the creation of 3-D plant animation, integrated with the physical set footage. But it was the French company’s distinctive style, as much as its technical acumen, that appealed to the *Batman & Robin* filmmakers. “One of the reasons we looked to Buf,” remarked Adamson, “is that they have an aesthetic that’s sort of sexy. Their look was perfect for Ivy’s world because she’s such a seductive character.”



Modelmakers ready miniature bridges for filming.



As in previous Batman films, giant statues are integral to the architecture of Gotham City.

After Bane tosses some squatters out of the old bathhouse. Ivy makes herself at home, casting her magic seeds and watching her lair fill with plants.

“These beautiful, colorful flowers fill the entire space,” related Arnauld Lamorlette, research and development head at Bufo. “Our CG plants weren’t the wonderful vines and flowers of a beautiful garden, but crawling jungle plants. So the whole place takes on this sweating, humid atmosphere of the jungle. The plants crawl around and interact with Ivy like they’re her pets, which required a lot of rotoscoping. And when you want to do things perfectly, you have no choice but to do rotoscoping by hand.”

Plenty of practical plant effects dressed out Ivy’s lair, as well – notably a giant unfolding orchid bed on which the temptress reclines as she attempts to seduce Robin. Alterian Studios was charged with building the orchid bed as an extension of Ivy’s twisted Earth Mother persona. “It was a mechanically articulated orchid with a translucent throne in the center that we both built and operated,” explained Tony Gardner, who co-owns Alterian with his wife, Cindy. “The scene begins with a twelve-foot-tall black onionlike thing, floating over a pool of water, that opens up like the petals on a giant flower, revealing a centerpiece pod with arm rests and a translucent back. The top petal was about twenty-two feet long, and the interior throne was made of soft fabrics over a clear acrylic pod.” To avoid any risk of crushing Uma Thurman in a mechanically operated rig, the orchid bed was manipulated by a team of fifteen puppeteers working a series of levers. “Five of the puppeteers were below the pod, which was suspended on the edges of the swimming pool. From there, each operated a steel lever. It took real muscle to push those levers, so we had big guys down there.”

Ivy’s hothouse habitat had its counterpoint in the icy environment of Mr. Freeze, who devised his schemes in an abandoned ‘Snowy Cones’ ice cream factory. The plant exterior was decorated with ice cream cone designs and a nearly fifty-foot-wide image of the fictional company’s icon – a frosty snowman character – in addition to the incongruous touch of razor wire fencing surrounding the facility. Rather than build a facade front complete with such complex ornamentation, the production elected to produce the Freeze lair exteriors – most notably a nighttime tilt-down from the Bat signal that reveals the plant surrounded by the Batmobile and flashing police cars – as digital matte paintings, rendered by Robert Scifo, who had provided paintings of Two-Face’s compound for *Batman Forever*. “Robert is a matte artist,” James Hegedus observed, “but he combines 2-D images with 3-D elements, adding his own animation and lighting effects that can be composited with a live-action plate. The result is something that’s totally created. Digital technology now allows an artist such latitude in creating images. The ability to compose a scene, light it, travel a camera through it and even create the characters allows one person to be all things – director, art director, cameraman and visual effects supervisor.”

Scifo’s basic tools were a Macintosh and Strata Studio Pro, a 3-D modeling, animating and rendering program. Even in the short interval since his work on Two-Face’s lair, the art of digital painting had advanced to the point that Scifo could actually composite his images with the live-action plates. “Using a Mac,” stated Scifo, “I can do a temporary comp, change something, or add an entirely different effect. If I was compositing in police cars, for example, and the lights were out of sync, I would just regenerate them; and minutes later I could put the whole thing back together. Or if John

wanted another spotlight moving across a building, I could literally have it there for him to see the next day. I could layer a single shot with maybe twelve different gags, which would have been very difficult to do in the past.”

Working with his cordless pen and tablet, Scifo did everything from selecting the appropriate digital brush to giving his images a three-dimensional quality. “There are programs that will allow you to put on paint three-dimensionally,” Scifo said, “but what I did for the Snowy Cones factory was paint each element separately and tell the 3-D program to wrap it around an object. For instance, if I had a waffle cone texture, I would paint it flat, as a two-dimensional surface, then go into the 3-D program and wrap it around a simple cone shape, rendering it in 3-D. Render times varied from minutes to hours, depending on the shot. After I composited the 3-D image with the live-action and any effects, I put the final on Exabyte tape and sent it over to EFILM, where it was recorded out to film.”

Deep inside Mr. Freeze’s lair is the source of his pain and passion – the fluid-filled glass case in which his young wife Nora is kept in suspended animation as Freeze frantically works on finding a cure for the incurable disease she has contracted. Although model Vendela Thommessen would play Nora in poignant home-movie scenes of the once happy couple, the Nora suspended in the tank was a completely fabricated creation of Rick Baker’s Cinovation shop.

The Bat Shop, which created the movie’s costumes, had done a lifecast of Vendela’s face that Baker had resculpted and attached to a nude body sculpture. “The body could have been done with a body cast,” Baker stated, “but that would have required a lot of recasting and cleaning up. Since we didn’t know what her gown was going to be like at the time, we had to make sure that the whole body looked good. So we created a nude Vendela sculpture using photos of her in a bikini as reference. It was made of flesh-colored silicone, over which we added a glaze of colors, with all the skin textures painted or sculpted on. Initially, I was concerned because we’d never had a sculpture completely immersed in water for a long time. So we did a series of tests beforehand with silicone in water, and from those tests we came up with a mixture that would not distort or change color.”

Originally, the production had created a cylindrical tank to serve as Nora's chamber. But Baker cautioned that the rounded glass would distort the sculpture's image, making the sleeping Nora look fat. When Baker's warning was proven true, it was proposed that to compensate for the distortion, Cinovation could produce a new Vendela sculpture that was 37% thinner than the original. "It's hard enough to create a likeness of someone, much less a likeness that's 37% thinner," Baker remarked. "I wouldn't even know how to do that. Another idea they came up with was to create a triangular piece inside the cylindrical tank, which would somehow compensate for the distortion. So we put our nude Vendela sculpture into the tank and they filled it to the top with water – which caused the tank to explode, with shards of glass going everywhere. It lacerated our sculpture, leaving big gashes in it. Fortunately, it wasn't cut in critical spots – mostly on the legs, which would be covered by the gown. That was the end of the cylindrical tank." The final film features Nora standing in a rectangular water tank flowing with bubbles.

While Ivy and Freeze plot mayhem from their respective dens, *Batman* and *Robin* orchestrate their crimefighting efforts from the regal grounds of Wayne Manor and the Batcave beneath. In the film's pre-release trailer, loyal butler Alfred noted that, with Batgirl on hand, it might be time to build a bigger Batcave-wise counsel taken to heart by the production when it built a Batcave for *Batman & Robin* that was grander and more cave-like than its predecessors. "The new Batcave had a definite strata," commented Greg Callas, head of Set Right Construction, the company that erected the all-new set. "Its walls were about sixty feet tall and two hundred feet long, and it featured a big tunnel entrance. Not only could the Batmobile drive in and out of that entrance, there was a kind of Lazy Susan platform on which the car could be lowered out of sight, about twenty feet below the stage."



Mr. Freeze unleashes his freezing ray – computer animated by Warner Digital – instantly freezing in place everything in its icy swath.



Mr. Freeze unleashes his freezing ray – computer animated by Warner Digital – instantly freezing in place everything in its icy swath.



For shots of Robin frozen solid by the ray, Rick Baker and his Cinovation crew created an exacting likeness of actor Chris O'Donnell in silicone.

In addition to his cavernous secret hideaway, *Batman* has always relied on his arsenal of gadgets and vehicles to fight Gotham's criminal element. For *Batman & Robin*, some key vehicles would be replicated in a variety of forms, with a redesigned Batmobile produced as a full-scale, operational vehicle, a radio controlled quarter-scale model and a computer generated replica. TFX – the company that had built both full-size and model Batmobiles for the previous film – produced some forty vehicles, including fourteen motorcycles designed for a Gotham biker gang, Robin's Redbird motorcycle, a full-scale Batmobile and Freezemobile, and two versions of a Bat-skiff, a practical vehicle requiring a snowmobile chassis, powered by propellers used for swamp boats in the Everglades.

TFX began its design process in February 1996, commenced construction in April and delivered its first vehicle, the Freezemobile, in August. Due to the firm's growing mastery of computer design techniques – learned by president Charlie Zurian and vice president Allen Pike in their earlier work designing prototype vehicles for General Motors –

TFX had been able to complete its ambitious *Batman & Robin* assignment in roughly the same time it had taken to deliver a much smaller number of vehicles for *Batman Forever*. "The typical movie car builder relies on methods learned building hot rods in garages," noted Pike. "Those methods work fine, but they are time-consuming and afford less design experimentation in the initial stages. The typical fabricator has to first develop and complete a chassis before being able to measure it and consider the body that will go over it. Because we do all our work in the computer, we can develop and build the chassis and body at the same time."

In design, the new fiberglass-framed Batmobile moved away from the bio-tech flavor of the vehicle in *Batman Forever* and toward a classically streamlined forties look. "The Batmobile was like an Austin Speedster coupe," Pike observed, "with long, out-stretched fenders coming out over the front wheels. The director wanted the feeling of this car coming at you from miles away; so we actually forced the perspective by narrowing the rear track slightly more than the front track. That created the feeling of the car being much longer than it really was." A key aspect of the vehicle's design was the Bat-mobile's exhaust flame. "We brought the flame effect up several notches on this film. Instead of one large nozzle, which was common on the previous vehicles, we had six flame nozzles, three coming out from under each of the fenders. That created a wall of jet propulsion. We injected a solution that changed the color of the flame, and nitrous oxide to help it burn, using propane as fuel. There was a button inside the vehicle *Batman* could hit to engage all the systems at once."



Studio artists Chad Waters and Kazu Tsuji apply vacuform plastic 'ice' to a methane replica of actor Michael Chan.

In addition to the full-size Batmobile for main unit use, TFX provided the miniatures team with quarter-scale replicas, to which Ian Hunter's crew added radio control capabilities, driving mechanisms, lights and other effects. "We definitely pushed the envelope," stated Kurt Williams, "particularly in the detailing of the cars. The Batmobile had six flames coming out of the back, aluminum wheels made from scratch, tires that had the bat symbol carved into the tread, and twelve on-board lighting systems that had to work in motion control. It was so complex we had to build several different Bat-mobiles to work in all the applications."

The twenty-three-foot-long Freezemobile – another TFX creation – combined aerodynamics and power in a steel frame and plywood substructure weighing almost 8500 pounds. Action shots were achieved with either the full-scale vehicle or a quarter-scale model. "The Freezemobile was supposed to have the look of an ice-cold vehicle," Eric Durst observed, "so a lot of the miniature photography involved getting the right look and feeling of cold. We placed liquid nitrogen in the cavities of our model, which changed to vapor when it was poured on."

Some shots featured missiles being fired from the Freezemobile, images that were computer generated by Cinesite. "We used a lot of CG tricks to integrate our elements," said Carlos Arguello, who supervised Cinesite's work, "such as making the missile's smoke trail interact with the Freezemobile by creating CG pieces of the car. Once a portion of the background plate went digital, we were able to go frame-by-frame to imitate the levels of color, et cetera, making sure everything fit together."

Mr. Freeze himself fit the profile of the villains of *Batman's* recent history. A key to the character's disturbing presence was his cryogenic freeze suit, a departure from the bubble-helmeted outfit of the comics. Among the stylistic requirements for the freeze suit was that Schwarzenegger's face be seen. "Instead of a bubble in front of Arnold's face," Ling said, "we designed a helmet that was supposed to cool the character. The idea evolved into Mr. Freeze being encased inside threatening-looking metal armor that kept a subzero inner temperature. The freeze suit was absolutely one of the most difficult things in the movie to do because it had to be able to function with thousands of low-voltage inner-suit blue LEDs running off a battery pack on the back, yet be light enough so someone could wear it. It was like wearing a car – but Arnold was fantastic in it."

Literally a suit of armor, the forty-five-pound hero outfit was hand-pounded in aluminum by armorer Terry English. An additional fifteen suits were needed for doubles and stunt work, each of which required a workable inner-lighting effect. With filming fast approaching, the production turned to TFX to roll out the extras. "Barbara Ling called us because she knew we were involved in manufacturing processes," said Allen Pike. "Since the suit was so mechanical in nature, it was right up our alley. We made molds off the parts that Terry English had produced, metal-sprayed an aluminum zinc alloy into the molds, and backed them up with fiberglass, essentially creating duplicate fiberglass suits that had a metal finish to them. We also put kevlar reinforcement in them to offer some protection when the character had to kick-box or do stunts. The nice thing was that the fiberglass suits were a bit lighter, more durable and more resistant to denting." To reinforce the idea that it was a functional cryogenic suit, the costume was equipped with thousands of blue LEDs to emulate the icy color of Freeze's world.

Mr. Freeze was also equipped with the essential freeze gun, a weapon that turns to ice anything its ray is directed at. Like the cryogenic suit, the gun was designed with practical effects to suggest its freezing power. “The practical gun discharged a carbon dioxide vapor,” explained John Dykstra, “and there were strobes on top of it. In addition, Stephen Goldblatt timed some very bright strobo-scopic lights on the set to create interactive lighting in the environment.”

Heading up the effects photography on the many sequences of Freeze unleashing his freeze ray was David Stump, a veteran of *Batman Forever* and a freelance director of photography. Stump worked extensively with the second unit and even shot his own third unit. Because of his specialty in technical photography, Stump took the lead in ensuring that all the elements in a freeze shot – the cameras, ambient lighting and freeze gun strobe effects – worked together. “In addition to the camera that was the taking angle for the freezing shots,” Stump said, “there were generally between two and four more live-action cameras circled around as reference cameras for the CG people who would be adding freeze effects. Part of the job was to synchronize everything – every shutter on every camera had to be open at the same time, so we’d be taking exactly the same picture at the same time on every frame of the camera. We also had to synchronize the discharge display on the front of the freeze gun to insure it would flash while the camera shutters were open.” Every blast of a freeze ray also required ambient light effects, which involved giant xenon discharge lamps provided by Lightning Strikes. All of the lamps were integrated by a signal from the master synchronizing unit. “Lightning Strikes had everything from small 35 kilowatt units for interior shots to hundreds of thousands of watts for big backlot scenes.”



Pheromonal 'love dust' – an interactive effect created digitally by Buf Compagnie – wafts off the palm of Poison Ivy.

The live-action footage achieved on stage was integrated with a computer generated ray effect. Sharing in the creation of the freeze ray beam were Warner Digital – which handled the rays fired from Freeze’s gun and Freezemobile – and Buf Compagnie, which produced a giant ray that emanates from the Gotham Observatory late in the film. Actual ray beam development began with John Dykstra, Andrew Adamson, Warner Digital and Buf Compagnie collaborating on a design that would work for both the gun ray and the big freeze effect at the finale. “The ray was not a solid beam,” said Wendy Rogers. “It was made up of numerous elements. Pulse lights were the most dominant of those elements, with the pulses traveling through a center core and illuminating all the elements of the beam, with wavy edges and a spiral effect on the outside. It had the feeling of an energy aura that encased and somewhat defined the beam.”

Warner Digital created its ray using the Dynamation particle program, modifying the rendering process so that the company could shorten potentially lengthy render times and complete its slate of sixty-five ray shots in a timely manner. “Dynamation is terrific for creating the dynamics of something,” Rogers explained, “but because it is a hardware renderer, we would have had to render all our shots at a workstation – which would have been untenable and also limiting in the look we could achieve with the particles. So, early on, we recognized the need to find another way to render these particles. I had experience exporting particles from Dynamation and rendering them using another package; so we wrote a code that exported all of our particle files into Alias. That gave us the access to be able to actually light and render our beams in a more sophisticated manner. The software renderer also gave us the ability to multiprocessing the renders.”

The impact of the freeze ray would emulate the force of an arctic blast, freezing people into instant ice sculptures, with directional icicles streaming off. For the computer generated ice effects, the photogrammetry process was again utilized, with pulsing LED markers providing accurate measurements from the live-action environment. “We used the photogrammetry process to remodel the scene in 3-D space,” Adamson explained, “mapping the original 2-D photography onto a 3-D model. That resulted in a photographic, three-dimensional scene in the computer, over which we could then apply the CG ice. To add ice reflections, we did ray tracing, which involves tracing individual rays of light for all of the refractions and reflections and shadows you’d expect from a real image.”

Throughout the movie, the freeze ray encases countless victims in ice. For these scenes, both Cinovation and Alterian Studios were called upon to create practical versions of frozen people that reflected comic book imagery of an ice ray hitting with a backlash that knocks off hats or glasses, sweeps back hair and clothing and leaves its victims frozen in place. Cinovation took the lead in developing the frozen body prototype, which, once approved, set the look for the iced characters in the film. In addition, Cinovation was tasked with producing principal-character freeze victims, including Robin and two scientists blasted with ice in Gotham Observatory. Alterian’s iced figures – thirteen in all – were fashioned by a crew of forty and ranged from a group of museum guards in an opening diamond heist to exterior street folk, including a man inside a frozen phone booth.

“I think our ice figures are the most realistic likenesses we’ve ever done,” declared Rick Baker, singling out for special praise Kazuhiro Tsuji, who did everything from lifecasting to hair work, and Chad Waters, who created the iced sculptures. Performers; dressed in tights and posing in their designated freeze positions, provided both companies with plaster-bandage body molds and alginate head and hand casts. Because of the difficulty in maintaining the often extreme positions for the length of time required to do the body casting, almost all of the lifelike creations required some adjustments. “We’d get close to the position, then alter it at the joints by sawing through the



During a frenzied car chase through Gotham, vehicles driven by Freeze and his thugs launch off a giant statue’s hand in a multi-element composite by Warner Digital.

hollow fiberglass shell to cut a wedge out and then put it back together. Then we could dress them out, putting a lot of wires and starch in the fabrics of each outfit to simulate movement. We made Robin's head in silicone and then painted it, since it would be seen closely; but most of the heads were urethane, with a flesh-tone color mixed into the urethane itself." The final step was to cover the realistic, highly detailed figures with an icelike material. "We sculpted and modeled and cast frozen ice bits in clear vacuform. Over the top of that, we put a clear urethane to make them look like they were encased in ice."

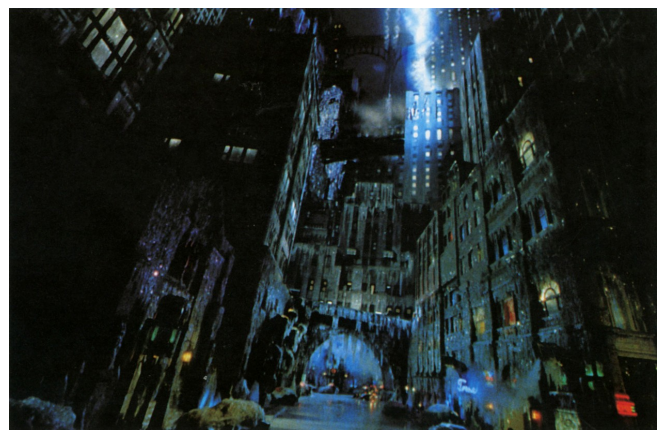
Frozen victims would first be revealed in the film's opening sequence – a fantastic skirmish in which *Batman* and *Robin* attempt to foil Freeze's museum heist of a priceless diamond. In a rocket deployed from within the Freezemobile, the villain blasts through the museum rooftop into the night sky, with *Robin* hanging onto the exterior and *Batman* frozen to the inside by a freeze ray blast. Freeze departs the rocket, escaping with the diamond via a flying wing built into his suit. *Robin* manages to free *Batman*, and the two detach the rocket doors and skysurf down in pursuit of Freeze as the rocket explodes behind them.

The sequence commenced with a quarter-scale Freezemobile rocket mounted on a post and catapulted through a quarter-scale museum rooftop. Both the rocket, equipped with nitrogen exhaust, and the rooftop set were provided by the Ian Hunter crew. “The rocket was standard-looking,” related Kurt Williams, “about four and a half feet long and maybe eighteen inches wide, with a metallic finish. For shots of its flying we filmed a motion control version that was composited with a CG city and sky. Since it was a signature Freeze rocket, we couldn’t have a red flame; we had to make it blue and cryogenic looking. We did the actual rocket explosion element the old-fashioned way, hanging the model outside, between two Condors forty or fifty feet off the ground, then blowing it up while we filmed with three high-speed cameras.”

Skyboarding away from the rocket, *Batman* overtakes Freeze in a scene featuring a seamless transition from a CG stunt *Batman* to a live-action shot of George Clooney – complete with CG cape – crashing into Schwarzenegger. For *Batman Forever*, Pacific Data Images had contributed a CG Dark Knight in a similar *Batman*-to-the-rescue sequence. Although creating a CG stunt performer had been one of the unknowns of that previous film, going into this one John Dykstra knew that it could be done – especially since the CG model would have the advantage of being a dark, smooth, costumed figure moving through a night sky. The challenge the second time around was to animate the synthetic figures with even more complex and realistic movements.

As they were on *Batman Forever*, the CG characters created by PDI were based on motion capture data recorded by Acclaim Entertainment. But while the earlier production’s motion capture had relied on moves performed by a gymnast, for *Batman & Robin* Acclaim used performances by members of the U.S. Army’s Golden Knights parachuting team, outfitted with skyboards and free-falling within a thirty-foot-tall vertical wind tunnel training facility at Fort Bragg, North Carolina. For reasons of safety, the team performed its airborne stunts dressed in simple black leotards, rather than capes and superhero costumes. More than thirty moves were captured during the one-day shoot by Acclaim motion processing manager Brian Windsor, motion capture supervisor Andy Acquilino and a crew of six. A second session would be held later, at the company’s New York studio, for additional scenes involving falling and ascending moves, collisions with surfaces and riding on vehicles.

“Motion capture data provides a rough foundation for creating believable human animation,” noted PDI effects supervisor Richard Chuang, “but it almost always requires manipulating and tweaking by a key-frame animator. For the CG characters in *Batman & Robin*, we had to adjust the data to make the motion captured segments work together, and add our own animation on top of that to make the human movements more fluid and believable. We’ve experimented with animating people motion, but it is still almost impossible to capture the subtleties. For example, the weight of a person walking is so relevant to an individual that when you animate, you can’t maintain the consistency of weight and



For a scene in which Freeze turns an enhanced version of his ray on all of Gotham, Buf Compagnie supplied the ray and created everything above street level as a digital matte painting.

detail needed to mimic that individual. While motion capture helps, at this point the idea of delivering a computer generated actor is still a few years out.”

The motion capture photography in the wind tunnel was accomplished with multiple cameras aimed at the skydivers as blasts of air kept them in an airborne state. A new twist on the technology was the fact that the performers were not encumbered by wires. “The system had witness points,” Chuang explained, “visible optical point markers on their bodies. By triangulating from multiple camera viewpoints, the 3-D position of each of the joint angles could be extracted. We took that data and applied it to the digital skeletons that drove the muscle and skin of our CG characters. Since the last *Batman*, we’d improved our system for manipulating the skin of a character. Now there is more muscle flex when a character bends his arm, for example, giving it a more realistic feel. This time, we also were not limited to individual motion capture sequences because we’d improved our ability to piece together different performances.”

For the shot of *Batman* hurtling down toward the flying Mr. Freeze, motion blur and general speed helped to disguise the transitions from the CG *Batman* to Clooney. Although the CG characters were never in extreme closeup, they were close enough to camera to pose the problem of replicating human skin, particularly the mouth and lower jaw, visible under the bat mask. “Fortunately, he didn’t have to deliver any lines,” Chuang said, “so we didn’t have to worry about animating his lower face. We just needed to see the resemblance of a person. We shot still photos of Clooney in various expressions, such as angry or aggressive, and we applied the actual image of the face to the CG performer.”



Scenes of people – and others – being frozen in mid-action were produced by Warner Digital.

Creating a falling Mr. Freeze for the sequence was not as straightforward a proposition, due to the character’s cryogenic suit, which was too complex to replicate in detail. The suit was also problematic when more traditional greenscreen photography was implemented to realize the falling Freeze shots. “Freeze is the last person you want to put in front of a greenscreen,” Chuang stated, “because he is so reflective of the green environment. Plus, they’d shot the elements with green lights – so with the greenscreen and the green lights, the character was totally green! Separating him from the green so we could insert him into the shots was a real challenge. Software written by our research and development department, along with hard manual labor and a lot of rotoscoping, helped to isolate him.”

The fantastic fall would take the characters through a succession of CG-created environments. “Once they fall past the top parts of the buildings, which are the models, we enter into CG enhanced miniatures,” explained James Hegedus. “They fall toward a burning electrical generating plant with big smokestacks. Freeze uses his freeze gun to slow himself down and create an ice storm that puts out the fire. For that, we did a motion control move on a smokestack miniature, complete with practical smoke elements. Freeze, *Batman* and *Robin* then all fall into the miniature, as does the camera.”

As the skyboard pursuit of Freeze continues, the movie cuts to deep in the Amazon rain forest, where mousy scientist Pamela Isley is working on a venom that might allow plants to have a fighting chance against the depredations of man. Nearby is the lab of the mad Dr. Jason Woodrue (John Glover), who schemes to use the toxin in an effort to create a super race. Isley's glowing green tent and Woodrue's adjacent lab are established in a moody, moon-and-lightning-lit shot in which the camera pushes in through the jungle, toward a clearing. The shot was accomplished by Illusion Arts, a company specializing in matte painting effects, and one of the returning vendors from *Batman Forever*. "It was very much an old-fashioned Disney-style multiplane shot," suggested Syd Dutton, co-owner, with Bill Taylor, of Illusion Arts. "Not only could we take a traditional effects approach and do it for half what it would cost to do CG, it was just more fun! We began with an oil painting; but by itself, that wouldn't have worked because the push-in would have been a giveaway that it was a painting. With motion control we were able to divide the image up into five planes on what was essentially an animation stand."

The background plane was a traditional, two-dimensional oil-and-brush painting of the moonlit sky, jungle and distant mountains rendered on a four-by-eight-foot piece of masonite. In the mid-ground was a glass painting of Ivy's tent and Woodrue's lab. The final three foreground planes were made up of miniatures mounted on movers to suggest the push-in. "To provide a sense of real dimensional movement," explained Dutton, "we had the foreground miniature planes moving toward the camera. The jungle set had everything from plastic fronds to real plants in the foreground, with a styrofoam miniature of a ruin that had a kind of Aztec or Mayan look. Then, as the camera moved towards the painting, the painting plane was moved away from camera, so the background appeared to be at infinity, as it would in real life."

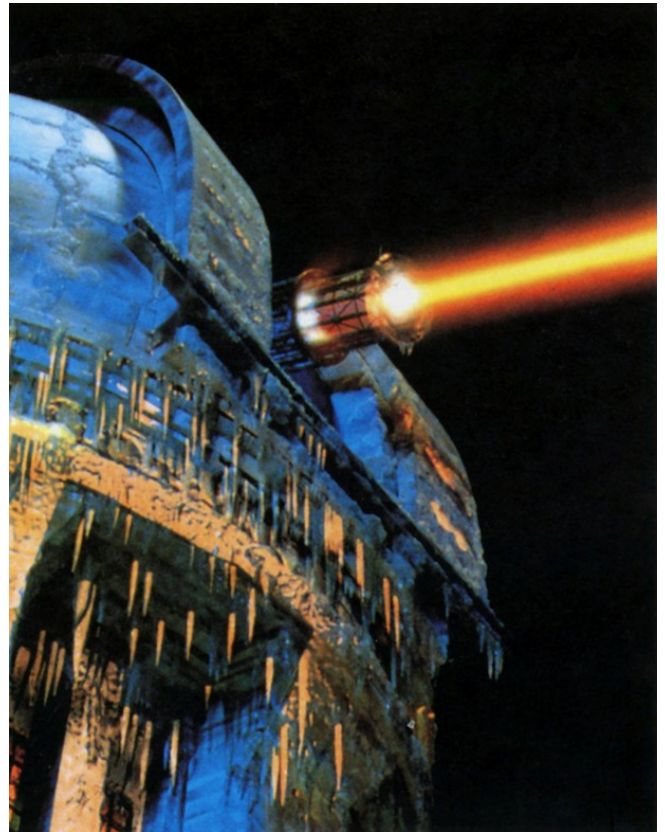
After a confrontation with Dr. Woodrue and his toxins, Isley is transformed into Poison Ivy, the beautiful but deadly seductress whose venomous lips enable her to kiss and kill – and who seduces potential victims with "love dust" blown from the palm of her hand. Buf Compagnie created the wafting effect. "When Ivy blows the love dust on *Batman* and *Robin*," explained Arnauld Lamorlette, "it is supposed to travel around them like a living thing. It's a magical dust made up of colorful particles that are putting a spell on them. It's meant to interact with them – so the dust is disturbed by their breathing or hand movements, and there are shadows cast on it." Working with an Exabyte tape of the live-action plate, Buf digital artists animated the love dust to react to the already-filmed reactions of the actors. "We had to do a lot of rotoscoping of the dust to make sure it moved around the actors and reflected the shadows and lights in the scenes. We created the dust particles themselves directly in the rendering process, using Mental Ray from Mental Image Company in Germany. We wrote our own shaders, which described the properties and textures of the dust, and plugged them into this rendering engine."

Back in Gotham, *Batman* and *Robin* are soon engaged in stopping another of Freeze's diamond heists – a confrontation that leads to the so-called rooftop chase. Conceived with the over-the-top action and kinetic visual composition customary to a superhero comics page, the rooftop sequence had the Batmobile and Redbird cycle in pursuit of the Freezemobile and a pair of thug cars, with the high-speed chase climaxing in an off-road drive up a giant human statuary figure – dubbed the Zeus statue – that dominates both the skyline and the Gotham Water and Power building. The cars blast through the statue's head, then race along the long arm and open palm and fingertips of the

Zeus figure before launching toward the nearby rooftops. The thug cars crash and explode, but the Freezemobile lands safely on a rooftop ahead of the flying Batmobile, allowing the super villain to use his freeze gun ray to turn *Batman's* car into a block of ice that crashes onto the roof.

"We storyboarded that sequence down to an inch of its life," remarked Barbara Ling. "It had to be very precisely laid out, in part because we were mixing different techniques and different scales. In that sequence, we go from twenty-fourth-scale buildings to quarter-scale model cars to live-action plates to CG vehicles and characters. It was quite a calliope of elements, all blended to create one spectacular, high-speed chase."

The off-road part of the chase featured models by the Ian Hunter crew, including a twenty-fourth-scale Zeus that replicated the full figure, and a quarter-scale model of the statue's head, neck and shoulders, through which the cars would crash.



A thawing ray – produced by Buf Compagnie – issues forth from the Gotham Observatory.

The radio controlled cars blasting through Zeus' head, and later landing on the rooftops, required a hundred feet of stage space to accommodate the physical launching of the vehicles. Overseeing the quarter-scale model photography for the sequence was Robert Spurlock, who took over model supervisory chores from Ian Hunter during the last four months of production, when Hunter departed for duties on *Alien Resurrection*. The sequence utilized pneumatic launchers, designed by Eric Heisler, to fly the vehicles through the statuary – rigged with breakaway neck pieces and detailed on the inside with broken beams and nitrogen and cryo bombs. At quarter scale, the launching of the models was no small feat – the Batmobile alone was some seven feet long and weighed between two hundred and three hundred pounds. "Quarter scale is a large size to work with," Kurt Williams noted, "but we chose it to get the proper shooting speeds and depth of field." Once again, animatics produced early in the production schedule served to expedite the model photography. "Although there are always adjustments you have to make on any miniature set, the animatics saved us from days and days of testing. We could feed in all the data, such as rate of speed, and it would tell us what kind of lens we needed and the distance the model had to launch."



The observatory miniature is readied for shooting.

While the cars bursting through the statue were filmed high-speed on the model stage, the subsequent action required computer generated models. "We picked up the action with the vehicles coming out the other side of the statue," James Hegedus related. "We shot motion control moves on the twenty-fourth-scale Zeus statue, then composited CGI vehicles that traveled all the way down the arm, onto the open palm and fingers, which formed launching ramps for each of the cars." This portion of the chase also employed backlit transparencies for the background, designed and executed in proportion to the quarter-scale rooftop elements. "What the backings allowed us to do was create a visually rich, expansive and realistic looking city, which we couldn't have afforded in quarter scale. It was a simple technique, an in-camera solution that worked beautifully."

Moments before Mr. Freeze blasts the airborne Batmobile, a PDI computer generated Batman is seen ejecting from the vehicle. The ensuing crash of the frozen Batmobile was realized with a quarter-scale model. "For the ice," remarked Hegedus, "we used urethane and a variety of materials, including facial makeup gel, which is really a crystal-clear, water-based silicone. The ice casing was prescored so it would fracture like ice upon impact. We also added liquid nitrogen to the Batmobile; so as it was launched, there was a beautiful frozen mist trailing it."

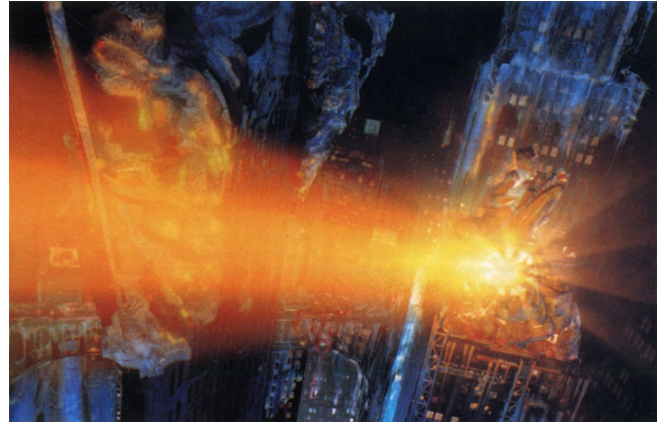
Despite setbacks, the Dynamic Duo manage to get their man, and Freeze is locked up in Arkham Asylum. But when Ivy springs him from the mental hospital, the villains team up with plans to not only defeat the Caped Crusaders, but enlarge the freeze gun capabilities to freeze Gotham – and ultimately the world. Their plan nearly comes to fruition when, in the finale, the Gotham Observatory telescope is transformed into a giant ray gun that freezes the entire city.

While Buf Compagnie computer generated the ray itself – emulating the look already devised for the smaller freeze gun beam – live-action views of frozen Gotham were achieved on backlot street sets at Warner Brothers and Universal Studios. At the Universal site, Greg Callas and his crew covered the street and buildings with a special ice effect and erected three bridge spans over the street, thirty-foot sculptured figures, more than two dozen cars encased in a clear shell of practical ice, and iced-over mannequins caught in mid-stride.

Simulating ice on the sets was one of the great challenges of the movie – especially since, in her designs, Barbara Ling had avoided a milky white ice in favor of a more translucent look. After consultations with chemists and several months of experimentation, the production came up with a number of solutions to the ice problem. “Whenever we wanted to put ice on horizontal surfaces,” said Callas, “or on streets or sidewalks, we used a clear urethane. We made molds that had a crinkly texture, like you’d see on an ice cube, and from those we made nearly a thousand flexible four-by-eight-foot sheets of urethane that could be rolled up and unrolled like a carpet.”

For vertical surfaces, the crew applied transparent vacuform plastic. “It was clear like glass,” Callas explained, “and also came in four-by-eight sheets. We used about 3000 of those sheets for the movie. There are only two vendors for this stuff in the U.S. and we literally bought up every bit of it in the country. We then laid it over a plastic mold of what we wanted the ice to look like, and we manufactured it using the vacuform machine at Warner Brothers. We had about four different molds, including an ice floe that came down twenty or thirty feet and dripping icicle molds we could hang off the bottom of the ice floe or off window ledges. We then screwed the stuff to the building surfaces and highlighted it with white paint.” A urethane spray was also concocted for use in encasing parked cars and other props in faux ice. Fifty-five gallon drums held the specially formulated urethane and a catalytic agent, which were pumped separately into a chopper gun equipped with a mixing device. When sprayed from the gun, the two components would mix, react and harden within forty seconds.

The observatory was the setting for a final confrontation between *Batman* and Freeze. In an effort to redirect the sun’s rays and thus thaw Gotham City and its inhabitants, the Dark Knight attempts to realign orbiting satellites – one of the observatory’s fantastic capabilities. But before *Batman* can accomplish the feat, he is engaged in a fight with Freeze that is a riot of colors and light. A



Buf Compagnie created the thawing ray and a computer generated Gotham for scenes in which the city is deiced and its citizens restored.

formidable stunt sequence employing multiple rigs and harnesses, the fight scene would ultimately require extensive wire removal. “Doing the wire removal itself is only the first part of the job,” commented Joe Gareri of Pacific Title Digital, where the lion’s share of the wire removals was done. “The second part is getting the final image back to a nice, rich negative with all the properties, densities and color saturation that the original negative had. Because the entire movie was so saturated with color, it definitely caused more work in getting the film back to its original state.”

In the course of the battle, Freeze sets off an explosion he hopes will interrupt *Batman*’s effort to thaw the city. While a full-scale observatory set had been erected for the live-action, exterior views of the explosion and the subsequent crash of the giant telescope required a sixth-scale replica, shot in the Syncro Hangar. The miniature observatory destruction was a high-speed shot, accomplished in three takes, with coverage by five to seven cameras. Adding to the complexity of the shoot was a series of more than ninety interior pyrotechnic hits, timed to coincide with the telescope’s fall from the building.

“The observatory telescope was actually on a cantilever that was driven from behind,” explained Eric Durst, who supervised the sequence, “essentially pushing the telescope through the observatory’s three floors. There was an extreme amount of weight on the front of the teeter-totter, and it was counter-balanced in the back. The telescope itself was mostly made of lead, so when it hit it would be crushed. It was like a knife slicing through butter. We had the pyrotechnics timed on the floors to break away, with the cantilever rod pushing down, actually triggering the charges. Five cameras shot anywhere from 120 to 210 frames per second. To get good coverage we had multiple telescopes and multiple fronts of the observatory, which allowed us to shoot the sequence about three times.”

Batman finally manages to get the satellites to direct some solar heat towards frozen Gotham, and the city begins to thaw. The heat wave was achieved by Buf Compagnie as an atmospheric effect. “It was a solid wall of warm light,” observed Lamorlette, “like the effect of sun through clouds you’d see in a romantic painting. We used Mental Ray to create this reddish light. To show the thawing effect, we generated a completely CG city, using texture maps from the miniature buildings. We modeled and animated the ice in 3-D, making it change shape as it melted. For the frozen people, we first created 3-D characters to determine where light and shadows would go, and how they would react. Once we had that information, we replaced the 3-D stand-ins with the real actors.”

With the city thawed and Freeze defeated, all is right with *Batman*’s world again – at least until the next super villain blows into Gotham. In a poetic way, *Batman & Robin* closed a circle begun back in 1939, when *Batman* was born and the entire superhero form was emerging as a unique fantasy of the American mind. In those early days, the seminal comic book artists tried to impart some of the revelatory dynamics of the moving pictures to their static comic book panels, making pilgrimages to sit in movie houses and drink in such visuals as the dynamic camera compositions dreamed up by Orson Welles and Gregg Toland for *Citizen Kane*. In an odd transposition, nearly sixty years later, *Batman & Robin*’s filmmakers turned to the work of those original artists for cinematic inspiration. The result was what Schumacher had envisioned – a living comic book divided not by panels but by frames of film. “For *Batman & Robin*,” Schumacher commented, “we were able to go mad – and it was so much fun. We were able to create the kind of excitement and fantasy you don’t normally see in an action movie, simply because we didn’t have to concern ourselves with reality.”

Those elements of fantasy were made possible by visual effects that had become remarkably facile. Where once John Dykstra was the 'No' man – restricting actors to hitting specific marks on the set and enforcing other limitations in service to effects technology – he was now enjoying the kind of creative freedoms normally associated with first unit photography. “Usually, the more technical the film, the less spontaneity exists,” Dykstra observed. “But because of new techniques, I am now able to be a contributor without pushing people to do things on the set in a very specific fashion. The actors didn’t have to hit exact marks, and Joel and Stephen could shoot things any way they wanted. We tried very hard to maintain a sense of spontaneity and to make the visual effects unit transparent to the production.”

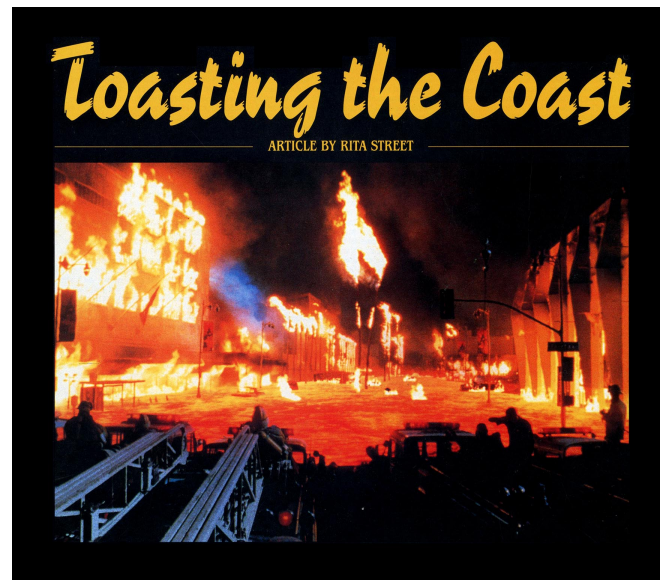
One noteworthy aftermath of the production was an announcement by Warner Brothers that, as of July 31, 1997, it was shutting down its Warner Digital unit. The statement, made almost two weeks before the film’s premiere, cited the difficulty of maintaining long-term staffing and technical and equipment needs. Industry insiders have voiced the opinion that the move is an effort to pare costs in the wake of parent company Time Warner’s recent \$7.6 billion acquisition of Turner Broadcasting Systems. Regardless, there was lament that the plug had been pulled on a CG company that had just revved up to speed and was showing promise.

Despite the vagaries of the business side of visual effects, there is no question that digital has become an integral filmmaking tool. “The truth about current effects,” Schumacher concluded, “is that there’s nothing you can think of that can’t be done. Computer generated imagery has come a long way; and it’s a great help in creating flights of fantasy. If we are lucky enough to do another *Batman* movie, the technology will have advanced even further. In fact, it is changing even as I speak. By next year, effects will have taken another new step into the future.”

Batman & Robin photographs courtesy of Warner Brothers. TMs and copyright ©1997 by DC Comics. All rights reserved. Production still photography by Christine Loss. Additional images courtesy of Warner Digital, Buf Compagnie, Rick Baker and Pacific Data Images. Special thanks to Jeff Walker and Jess Garcia.

TOASTING THE COAST

ARTICLE BY RITA STREET



When screenwriter Jerome Armstrong first entertained the idea of a grand-scale disaster epic reminiscent of the thrill-packed Irwin Allen movies of an earlier decade, Los Angeles – having endured such real-life calamities as firestorms, mud slides, earthquakes and riots – seemed an ideal choice for its urban setting. So, in *Volcano*, a Twentieth Century Fox release directed by Mick Jackson and based on a screenplay by Armstrong and Billy Ray, Los Angeles once again finds itself at the epicenter of calamitous events when a subterranean volcano erupts, threatening to devour the city.

The story opens with a 4.9 temblor hitting the Los Angeles basin. Rumbling through urban neighborhoods, the earthquake shatters the otherwise mundane routine of Mike Roark (Tommy Lee Jones), divorced dad and head of the city's Office of Emergency Management. Leaving his petulant teenage daughter Kelly (Gaby Hoffman) at home, Roark rushes off to investigate a mysterious incident in which members of a public works crew have been fatally injured by an underground blast of superheated steam. When seismologist Amy Barnes (Anne Heche) suspects volcanic activity, an understandably skeptical Roark ignores her recommendation to shut down the Metro rail line that runs beneath the city. The issue becomes moot, however, when a massive quake hits the following morning. Confirming Barnes' worst fears, the seismic disturbances are quickly followed by an even more cataclysmic event – a volcano erupts from beneath the La Brea Tar Pits, spewing ash and molten lava. Pitted against this force of nature are Barnes and Roark and the city's diverse agencies, who unite in a wild race against time to stop the lava flow, moving straight down Wilshire Boulevard.

In an equally wild race against time. *Volcano* would come head to head with Universal Pictures' similarly themed *Dante's Peak*, which was on the production fast-track, aiming for an earlier release date. Fox, in a bid to beat its rival to the boxoffice, would impose an incredibly tight schedule on the effects-heavy *Volcano*, presenting Jackson – new to the effects genre – with a challenge of staggering

proportions. “It was a matter of plowing forward and prepping the film while simultaneously working out the effects,” stated producer Andrew Davis, “which is not the usual way you approach a project. Normally you have a longer R&D to figure out how you’re going to execute scenes before you start prepping. We had to push blindly forward, playing catch-up the whole way.”

Hired by Davis and executive producer Lauren Shuler Donner to oversee an ambitious slate of more than 250 shots was visual effects supervisor Mat Beck. Beck would be supported by a large miniature effects contingent under miniature effects supervisor and director of photography David Drzewiecki and miniature pyrotechnic and mechanical effects supervisor Joseph Viskocil. A parallel effort within the digital realm would feature the work of Beck’s own company, Light Matters, together with VIFX, Pacific Ocean Post, Digital Magic and Digiscope. Complementing the visual effects effort would be equally ambitious on-set effects, guided by special effects coordinators Clay Pinney and Marty Bresin.

With just twelve weeks allotted for preproduction, the first order of business was preparing for the burning of Wilshire Boulevard, much of which would have to be filmed on a full-scale street set. Needing an unusually large space in which to recreate blocks of the street in full scale, the producers took to the air, scouting potential locations by helicopter. “We covered the entire city of Los Angeles and came up dry until we spotted the parking lot at the McDonnell Douglas Aircraft plant in Torrance,” noted Shuler Donner. “I remember looking down and thinking. That huge open area down there – that’s it!”

Under the supervision of Pinney, Bresin and production designer Jackson DeGovia, work was begun transforming the McDonnell Douglas parking lot into a metropolitan street set. One of the largest ever devised for a film, the set would replicate the Miracle Mile, a stretch of Wilshire encompassing the La Brea Tar Pits, the Page Museum, the Folk Art Museum, the Los Angeles County Museum of Art, the Peterson Automobile Museum and the now vacated May Company building.

The finished set would measure three-quarters of a mile long and cover some 750,000 square feet. Buildings were constructed close to full-scale, with the tallest—a replica of the art deco May Company – reaching a height of seventy-five feet. Ground zero for the volcanic eruption, the La Brea Tar Pits alone would measure some 20,000 square feet and would include a 550,000-gallon lake. To lend absolute authenticity, the set was fastidiously dressed with sidewalks, concrete curbing, sod, hundreds of palm trees and replicas of every Wilshire Boulevard street sign, light pole and traffic signal.

To film the fiery scenes of destruction, nearly everything on the set was rigged for burning and reburning on a nightly basis. “We shot twenty-six nights on the Wilshire set,” recalled Pinney, “starting at the Tar Pits and working our way down the street for continuity. That meant that the buildings we set on fire the night before had to go up again in the same manner the next night.” To accomplish the reburns, Pinney and Bresin relied on fireproof construction, achieved by shielding drywall with overlapping sheets of metal. A method was even developed for fireproofing real palm trees. “I was surprised to find how sturdy palm trees really are,” Bresin noted. “If you set them up right, you can burn them over and over again. To fireproof ours, we cut down the crown and added metal sleeves that held real fronds, which were replaced after each burn.” To effect the nightly burns, crews used an average of 1700 gallons of propane, 300 cans of sterno and eight gallons of

rubber cement per day. “We pulled the largest fire permit in the county’s history for this film; but it was still the safest set I have ever worked on. Everything was preplanned and documented. We had paperwork and maps locating every pipe and every valve.”

The special effects team was also responsible for ashing the set each night to simulate volcanic fallout from the eruption. During preproduction, Pinney and Bresin had investigated several types of ashlike material, but had found most to be health hazards. Eventually they contracted with a paper shredding company whose byproduct could be purchased by the truckload. “It was undyed gray paper with no chemicals in it,” explained Pinney. “To shoot the ash over the set, we brought in large insulation blowers mounted on trucks. Those were hooked up to air movers that were lifted on cranes about fifty feet into the air. The fake ash was pretty annoying stuff – sort of like having bugs one inch from your face when you’re wearing repellent – but it looked good.”

In addition to the burns, dozens of large-scale stunts – from overturning fire engines to plunging Roark’s Suburban into the lava – were rigged on the Wilshire set by special effects supervisors Jan Aaris, Al Broussard and Larry Roberts. For a shot of the La Brea Tar Pits mastodon sinking into the boiling lake, a replica of the life-size model was built and mounted on a hydraulic platform, then lowered into the water. An even more elaborate gag, guided by special effects foreman Eric Dressor, involved exploding manhole covers along the boulevard – the first indication that deadly forces beneath the city are reaching critical mass. To accomplish the effect, huge vaults were dug under the streets of the Torrance set, equipped with giant air compression systems and smoke-producing Navy foggers used to simulate shooting steam. When the compressors were fired off, the lightweight manhole covers – made of plywood and cast foam – were blown seventy-five feet into the air.

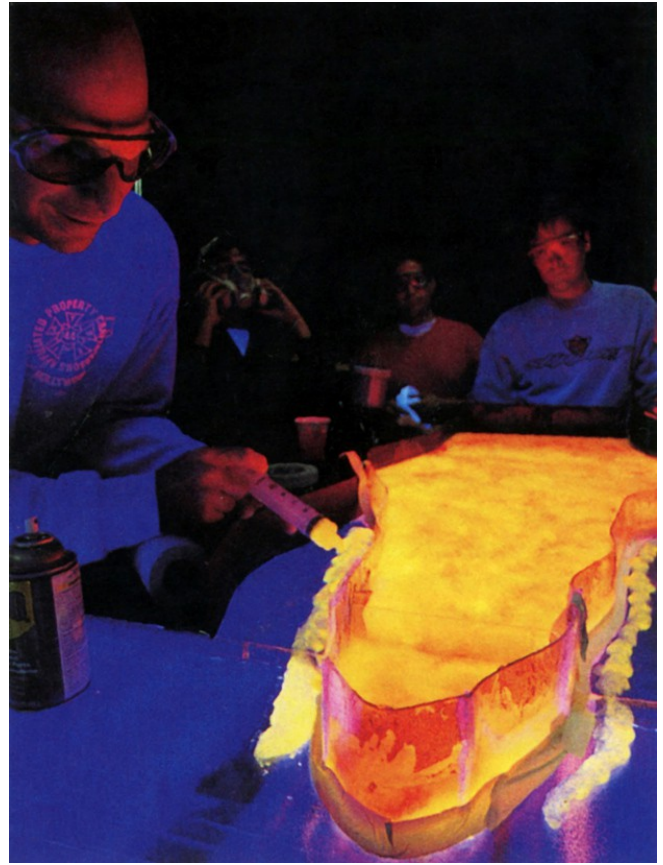


Molten lava flows out of the La Brea Tar Pits and onto Wilshire Boulevard in a shot assembled by VIFX for the Mick Jackson film. Volcano.



Most of the lava elements were photographed in miniature using tinted methocel with a black lacquer crust, backlit with ultraviolet light.

Another effect rigged on the set was a smoking lava bomb, one of many spewed from the volcano as it erupts. While flying lava bombs would be rendered digitally by VIFX and Light Matters, two shots featuring the bombs lying on the ground were accomplished live-action, using an articulated model built by creature effects specialist Kevin Yagher. Measuring four and a half feet tall and about six feet in diameter, the full-scale simulation was constructed out of silicone sandwiched between black urethane plates molded in the shape of the bomb and sitting on a fiberglass shell. “Lava bombs don’t come out round,” observed Yagher. “As they twirl through the air, they take on interesting, weird shapes. And sometimes when they land, they cool so fast that they actually have hot lava still inside – which causes them to spit or even explode.” To effect the look of molten lava within, the bomb was illuminated by a mix of incandescent and fluorescent lights positioned beneath the fiberglass shell.



Plexiglass troughs and forms were used to direct the flow.

On set, five members of Yagher’s crew puppeteered the lava bomb. “They wanted it to have some life-to undulate and bubble and spit and smoke,” related Yagher. “So we had puppeteers in trenches below ground, with part of their bodies up inside the bomb. They used handles on the plates to create undulating moves, and operated an air cannon that could spit, on cue, orange-tinted streams of methylcellulose.” In addition, smoke was blown through tubes in the model, and keyboard controls inflated internal bladders to create bubbling and popping effects on the surface. In postproduction, the shots were scanned into a computer and enhanced with flame elements.

While set construction was underway, the race was on within the multiple effects unit to find a methodology for Volcano’s most prominent effect – the river of flowing lava that cuts a swathe of destruction through the city. “We had a villain in this movie that was exclusively a visual effect,” stated Beck. “There really is no other bad guy – the principal antagonist is the lava. So we had to make it work. It had to be realistic and it had to be scary so that audiences would believe that the people in the movie were in peril.”

Faced with developing technologies on the run. Beck had been hesitant, from the start, to commit to any one technique. Instead, his goal was to concentrate on three different approaches, all aimed at creating convincing lava effects. While the first involved on-set effects, the second and third had to do with creating the lava as either a miniature or digital effect, to be composited into the live-action scenes. “The idea was to run all three approaches on a parallel course through the R&D and principal photography phases so that – in a best-case scenario – we could utilize all three and be able to cut between them as necessary,” Beck noted. “I think one of the reasons the effects ultimately worked so well in this film was that we were able to develop a real synergy between the traditional and digital approaches. The show wouldn’t have looked as good, at least from an effects standpoint, had we committed solely to one approach or another.”

On the live-action set, efforts to create the lava practically met with varying degrees of success. “One of the early production techniques involved the use of lava sleds,” explained Beck. “Those were fiberglass structures with lighting effects inside that were pushed across the set. But the sleds had too much structure; and no matter what we did, they just looked like a bunch of lighting effects moving across a fiberglass surface. As a substitute, I suggested taking a translucent plastic tube, filling it with air, putting some lights behind it and a flame bar in front. That worked fine for brief moving shots; however, on many shots – where you could see it clearly – it didn’t hold up. In those instances, we used it to pull a matte and ended up replacing it with CG lava.”

Efforts were also made to introduce interactive lighting on the set, since a molten lava flow would naturally illuminate the surrounding environment. “For those effects, Theo van de Sande – who was a terrific director of photography and flexible in the crunch – came up with the idea of using light bars,” Beck remarked, “just wooden planks with a bunch of



Clouds of ash and debris erupt from the tar pits prior to the lava flow.



cyclorama lights on them, shoved along by a covey of grips on their hands and knees. Theo also was not above walking down a train track holding a 1K in his hand when I needed some extra intensive light.”

Paint injected into a water-filled tank produced the ash cloud elements.

Other simple tricks included putting orange lights on a stand or on sandbags to create interactive illumination, or swinging a 10K light through the street set to suggest the leading edge of the lava flow. Small dollies equipped with lights and diffusion materials were also devised to be pulled through scenes. The wagons enabled postproduction effects teams to isolate moving shadows and add them to the lava’s leading edge. Digital painting and manipulation would enhance the effects shot on set.

Even before principal photography was underway, Beck and a core crew that included Dave Drzewiecki, Joe Viskocil and Viskocil miniature effects foreman Emmet Kane had begun to explore means of achieving miniature lava flows that could be used in conjunction with models, or shot separately and composited into live-action backgrounds. Picking up the reigns from the production art department, which had done some promising early tests, they experimented with a variety of lava and crust mixtures illuminated by ultraviolet light. At the start, they shared a Culver City studio with Clay Pinney’s physical effects crew; but when the work outgrew its allotted space, they relocated to a separate base of operations – a warehouse in Santa Monica large enough to accommodate both testing and shooting.

At the new location, the lava team quickly expanded both the size of its crew and the scope of its experiments. The favored lava solution was water-based methylcellulose, combined with a variety of substances such as chunks of polysorb, stearic acid and cork to give it varying degrees of texture and viscosity. “We were limited in that we couldn’t use anything that wasn’t biodegradable,” stated Drzewiecki. “It had to be nontoxic and safe to dispose of because we were going to be dealing with big volumes of the stuff. At first, we were buying the methocel premixed; but we had problems with clarity – some of it was like glue and some was clear and runny. Later we began mixing it ourselves, using a powdered form. We knew we were going to need different viscosities of lava, so Tom Zell, our lava effects foreman, custom built a viscometer – just a big funnel with a valve and jar underneath marked with premeasured increments – to standardize the mixing process. By timing how long it took for our mixture to travel from the funnel and fill the jar to a certain level, we could measure how thick it was.”

Pigments sensitive to ultraviolet light were used to color the methocel. In early tests, small amounts of the synthetic lava had been combined with dayglo red, orange and yellow pigments in a pyrex dish. “When we put white light underneath the dish, the methocel didn’t do anything,” related Drzewiecki. “But when we backlit it with ultraviolet light from below, moving it back and forth so that the density shifted, it subtly changed colors – just like a real molten substance would do. When a molten substance is hot, it appears yellow, and when it gets cooler, it turns red. Our lava did exactly the same. Since the UV light could only travel so far before it would decay, when the mixture was thinner it was brighter, and when it was thicker it appeared darker and redder.”

To get the lava to flow, the lava team tried testing its mixture on a tilting tabletop fashioned from a sheet of four-by-eight-foot plexiglass, with UV light panels underneath. Oddly, nothing happened. “We couldn’t believe it,” Drzewiecki recalled. “The lava just looked dead. It was several minutes

before we realized that the plexi we'd purchased had UV blockers to keep it from yellowing. As it turned out, ninety-nine percent of all plexi has UV inhibitors." Searching for a manufacturer who could provide plastic that would transmit ultraviolet light, Drzewiecki finally located one in Massachusetts who produced pure plexiglass for tanning bed covers.

Waiting six to eight weeks for the plexiglass to arrive, the lava crew began to puzzle out various requirements for building tiltable miniature lava sets. The degree of tilt on the sets would depend, in part, on camera considerations. "No matter how much UV we put on our lava," Drzewiecki said, "at a certain point we realized we were only going to get so much light. By reverse-engineering camera exposures, we could calculate our camera stops and camera speeds; and from that we concluded that the effect would work best in eighth scale – which is pretty good for miniatures. Since we had to be able to carry focus all the way across a plane of lava-which entailed filming at roughly four to six frames per second – we couldn't shoot realtime. So instead of having our lava table slope at thirty-five degrees, we changed the slope to approximately three degrees and ran the camera slower. Fortunately, the movie never had really fast-flowing rivers of lava. Had that been the case, it would have been difficult to pull it off with this technique."

Even so, for the technique to work, a means for easily manipulating the pitch of the entire setup was required. "We had an idea that if we built a big stage platform on a gimbal," said Drzewiecki, "with the camera, the lights and the tabletops all on the same plane – everything could be tipped together. I was poking around the back of one of the stages at Fox and saw an old, hydraulically operated gimbal. We arranged to have it sent to the effects shop, where Clay Pinney had a new pump and hoses put on it, added some hydraulic fluid and had his crew fix it up."



A digital lava bomb hurtles through the air in a shot produced by VIFX.

An aluminum platform, assembled by Viskocil foreman Mick Duff and key grip Mark Roemmich, was positioned on top of the gimbal with leg supports added to keep it from tipping over. The forty-foot-square stage accommodated two lava tables, twenty feet long and five feet wide, and rotated on both X and Y axes. Ultraviolet light panels, eighteen inches wide by four feet long, were placed side by side under the plexiglass tabletops. As shooting progressed under Drzewiecki and miniature directors of photography Eric Swenson, Allen Blaisdell and Michael Condro, four more sets were added, all on chain hoists or gimbals, bringing the total lava table count to six.

But there was still a thorny problem to contend with. Having tried everything from wax to chocolate syrup, the frustrated crew still had not come upon a workable solution for the lava crust. Finally, they experimented with sprayed-on black lacquer, and the results began to look promising. Lava effects painter Scott Valdes, brought in by Joe Viskocil to oversee lava preparation chores, helped to refine the look. “Scott brought in a painter’s perspective,” said Drzewiecki, “adding inhibitors to the paint to make it dry slower, testing different colors to give it depth and applying different spray techniques.”

The final lava mixture would be poured over and through miniature sets, designed so that the miniature flow paths would match those suggested in the live-action plate photography. When those miniature elements were composited into the live-action footage, the illusion of lava flowing through streets would be complete. A team of twenty-four artists, led by Tom Zell, was charged with creating the lava sets entirely out of clear acrylic. Using detailed measurements taken on the live-action sets and projected frame clips of each shot, the Viskocil team identified key points on the lava table that corresponded with objects in the frame, such as curbs, telephone poles, streets or buildings – anything that affected the flow of the lava. Next they heated and bent clear acrylic to form the varied shapes and patterns in sixth or eighth scale, then glued the pieces to the tabletop with clear acrylic cement. “Every miniature set was custom built in this way,” explained Emmet Kane, “in order to allow the lava to flow realistically. If the lava had to take a right turn or go over a curb or around a car, we had to recreate that with the tilt of the table and these individual set pieces.”



For scenes of a sputtering lava bomb lying on the pavement, Kevin Yagher Productions built a full-size mechanical prop.

In certain cases, when camera angles caused the plexiglass to act like a mirror, reflecting the lava in its surface, other materials were employed.

“Sometimes we used shower glass for the table,” said Zell, “because it had a frosted look, allowing light through, but not reflecting it. Or we would wrap the various set pieces with bobbinet, which is a thin woven screen. The bobbinet had a real advantage because it allowed the UV to shine through from the bottom, but kept out reflections from the sides, acting like a screen door.”

Before each shot, the effects team also had to determine the specific lava mixture needed. “There were lots of ingredients that went into the mix,” noted Kane, “and what we used for any particular shot depended on what was happening in the scene. Sometimes the lava would be coming out of the ground hot and yellow and fresh, without a lot of texture. Other times – when the crews are fighting it with water, for example – we had to make it look thicker. Every take had its own special formula. By the end of the movie we went through 45,550 gallons of methocel and 650 pounds of pigment!”

Shooting would often take place on six stages at once, with each lava table demanding a miniature crew of four effects technicians, two painters, plus camera, grip and electric crews. To provide a continuous supply of the lava mixtures, batches were custom-brewed in a lava ‘kitchen,’ headed up by Jim Valdes and run like an assembly line. “We were using three different viscosities of methocel, three different pigments and three different sizes of polysorb chunks,” stated Zell, “doing a couple of pours a day on each lava table for a total of 598 pours. We would literally take our orders to the kitchen – like you would in a restaurant – and ding a little bell.”

When a lava order arrived at a designated table, the Viskocil crew poured the mixture into a holding trough that extended behind the path that the lava would follow once it entered the set. Two painters were needed to apply the pigments – one to create a trough for the pigments, using a pair of paddles submerged in the methocel mixture and held side by side like butterfly wings, the other to pour the pigments into the mixture in lines of color. Taking care not to blend the pigments in, team members stirred them with a hand movement dubbed ‘twist-o-flex.’ “You didn’t want the colors to mix and create some new color of orange,” Zell explained, “so you made your hand into a claw, sank it into the methocel, moved it a quarter turn in one direction and then withdrew it. Everybody on the crew knew the move.”

After appropriate-size polysorb chunks were added, a plexiglass gate was raised on the trough, and the Valdes crew had just twenty seconds to airbrush on the crust before technicians pushed the lava through with a two-by-four. Once the crust was applied, another team would step in with wadded paper towels and shatter it. “The trick was to barely touch the paint with the towel,” commented Zell. “If we did the shatter just right, it would crack and look like millions of little



Mike Roark (Tommy Lee Jones) searches for an escape route from the advancing lava in a scene composited by VFX using full-size and miniature elements, digitally augmented.

lightening bolts running across the surface. Typically, we would add another coat and shatter again. Eventually, we got really tuned in to what was needed for each shot.”

As the lava crew became ever more proficient, techniques were refined even further. For example, having observed that there was no way to aim the lava – no matter what path it followed, it would choose its own course once the path ended – the crew found ways to control it. “Because it was essentially a liquid,” recalled Zell, “it always wanted to move in a circular pattern; so as it reached the end of a trough, it would pancake out, even backtrack on itself. Whenever that happened, it ceased to look like real lava.” To avoid the pancaking situation, the team incorporated various cheats. The most efficient entailed inhibiting the flow of lava with a mixture of tapioca-sized polysorb chunks, dubbed ‘salmon eggs,’ which added just enough texture to the shape of the leading edge to divert the flow slightly from its original path. If a larger change in direction was needed, a piece of formed plexiglass was added to the lava set. If really major moves were required, the crew resorted to more drastic methods. “One of the first things we had to do was a shot where the lava comes out of the Tar Pits and runs out onto the street, turning right as it travels down Wilshire Boulevard. That big of a move was difficult to fake even with curved plexi. So in that instance, we moved the gimbal to shift the flow.”

Some scenes required the lava to sputter and pop. For those, Viskocil pyrotechnician Donn Markel placed small air bladders below the surface of the mixture. In other spots he planted small black powder and smokeless powder squibs. When fired, the squibs created tiny explosions under the methocel, forcing it up in miniature geysers. For variety, the crew used paint guns to shoot air at the lava surface or slingshots loaded with tiny clay balls. “Because the surface was not in motion on those shots,” Kane said, “we had to use a different material for the crust. Christmas tree flocking seemed to work best because it was interactive – it actually allowed the lava to spout up through its surface. We got it from a local outfit that delivered it premixed in black powder form.”

Among many difficult shots tackled by the lava team was one in which Roark and Barnes lower a video camera down a Metrorail tunnel to determine if the lava is flowing underground toward the Beverly Center. Just as the camera enters the tunnel, it is engulfed by an enormous wall of rushing lava. “We used a plexiglass tube – about a foot in diameter and eight feet long, with a plunger at one end – mounted on one of our tilting tables,” said Zell, “and pushed our lava mixture through it at a very high rate of speed to make it violent.” Rather than relying on UV light, the crew used more tungsten light – a brighter illumination source – enabling the camera to increase the depth of field on the shot so that the lava looked less like a miniature.

Besides flowing lava, some of the most dramatic effects would involve the spewing volcano that rises from the La Brea Tar Pits lake. While the lava team was at work on six of eight stages at the Santa Monica studio, another crew, tasked with supplying volcanic cloud elements for the eruption, occupied the remaining two. After studying footage of real volcanic eruptions, the effects team had decided to use traditional cloud tank technology to simulate the mushroom-shaped pyroclastic cloud that forms above the lake. Not only was a practical approach cheaper than a digital one, it was faster, since the crew could do hundreds of takes simply by emptying the tank and refilling it. Practically generated clouds could also be customized to fit any background plate that first unit provided.

First, however, a suitable tank had to be located. Although cloud tank technology had been around for decades, most effects houses had relegated their tanks to the trash heap in favor of newer digital techniques. “I was afraid we might end up having to build one,” Drzewiecki remarked, “but since that would have cost about \$30,000, we did some detective work. We needed a tank that was really tall – at least seven feet – and we finally found a vendor in the San Fernando Valley who manufactures acrylic aquariums for use in high-end venues.” A 2100-gallon tank was selected and transported to the Santa Monica stage, where it was prepped for shooting. “We used heavy-duty swimming pool equipment for our pumps and filters, and had a couple of 1000-gallon holding tanks – one for fresh and one for salt water.”



Above an expanse of molten lava, Roark and Amy Barnes (Anne Heche) hang from a fire engine ladder after rescuing an injured motorist in a greenscreen composite produced by VIFX.

Locating a cloud tank artist was nearly as difficult as finding an appropriate tank. Fortunately, Drzewiecki was acquainted with local artist Mark Hartman, whose cloud tank work in *Independence Day* had gained him recognition as a specialist. With Hartman on board, the tank unit began performing tests in a 200-gallon aquarium, but soon abandoned the smaller tank in favor of the real thing. “We couldn’t resist playing in the big tank,” Drzewiecki admitted. “We started testing different mixtures of paint with fresh and salt water. In the end, we found that tempera paint, in mixtures of black, white and gray, worked best.” Initial tests involved pumping paint mixed with salt water into the top of the fresh water tank and photographing the results with the camera turned upside down. Although this created the lovely ‘cauliflower’ effect Mick Jackson sought, the cloud itself did not roil in a particularly violent fashion. “Mick had put together a videotape that he called ‘The Six Stages of Lava.’ In it, there was footage of a volcanic eruption in Hawaii where lava, flowing off the land into the ocean, causes steam and ash to shoot up in a dramatic way. Since that was the image he wanted to duplicate, we had to put the gravity method back into our bag of tricks and instead try shooting the tempera up from the bottom of the tank.”

This time, fresh water mixed with paint was injected into a salt water solution. Although the results looked more turbulent, the effect was still not dramatic enough; so Hartman retreated to his workbench, devising a system of nozzle heads that could be attached to a rotating gimbal at the bottom of the tank. “I created a series of custom-made heads, each with a different shape. There were concave heads, convex heads, sprinkler type heads, even one that looked like the blades of a helicopter, with four little fins that spun around.” To vary the pressure of the incoming paint, pressurized paint pots were linked by hoses to the tank. These pots, in turn, were controlled by a pressure sealer that could be rotated to increase velocity or even introduce the occasional air bubble. By adding bursts of air from the pots to the heads, a team of four could manually increase the dramatic look of a forming cloud. Drzewiecki accelerated the effect by undercranking the camera.



Computer generated lava – created by Light Matters – was used in select instances, including several helicopter POVs of the disaster area composited by VIFX.

In addition to the pyroclastic effects, the tank unit filmed several inversion layer cloud effects for panoramic aerial shots of the eruption. In nature, an inversion layer occurs when a layer of warm air prevents a cooler layer from rising, causing it to flatten out. A similar reaction could be induced in the tank using density variations rather than temperature. “First the tank is filled halfway with salt water,” explained Hartman, “then a thin covering of polyurethane sheeting, called visqueen, is laid over the top. After fresh water is added, tempera is injected up through the bottom of the tank and the visqueen is pulled out gently. Because the paint is lighter than the salt water, it rises. But when it hits the lighter layer of fresh water, it spreads out, creating the inversion.”

A number of practical geyser elements were shot for the lava eruption at the Tar Pits, as well as for a later sequence in which an underground lava flow, reaching the end of a subway tunnel, breaks through the ground in front of the Beverly Center. Initial tests for the geyser effects were conducted

at the Santa Monica studio using a system of twelve air cannons, devised by Viskocil and his team, to pump the lava into the air. “We experimented with different viscosities,” said Viskocil, “testing each to see how high we could make it go or how high we could shoot it at a continuous rate.” When the experiments were concluded, the geyser elements were shot in San Bernardino at Jack Sessums Company by Sessums director of photography Michael Sajbel. The air cannons were fitted inside a huge steel cone built by Stirber Visual Network. Screen mesh and baffles on the cone provided a surface for the lava to disappear into as it landed.

Toward the end of production, a second shoot was conducted in the Santa Monica facility parking lot when the studio decided it wanted bigger, more dramatic geyser effects. On the second go-around additional exploding geyser elements were filmed, again using the Viskocil team’s air cannon system, plus several new cones contributed by Stirber. “We spent a week trying to think of everything we could to make the eruption more dramatic,” stated Mat Beck. “We did a lot of tests and ended up setting the cannons off in groups to give it a random, scary quality. There were so many problems that had to be solved to make it work. Since it was supposed to look like a fifty-foot-tall tower of molten rock, we tried all kinds of tricks to give it mass and scale – such as hitting it with wind to try to break it up on the top. Then we had to have a whole platform of black honeycomb material so that the lava had someplace to go when it landed – otherwise we’d have to extract the geyser element from this big glowing pool of goop.”

A variety of lava concoctions was used for the geyser effects. Mixed in varying thicknesses by Scott Valdes, the result was a ‘parfait’ of methocel, globs of polysorb and dayglo pigments, designed to bounce around and fall in interesting ways. “One of the ironies of lava is that you have to cheat it a little,” stated Beck, “because the real stuff sometimes doesn’t have a lot of detail. It just flows like orange water.” For shots revealing the lava’s interaction with the cone, one of the Stirber models was covered in black foil so that burning charcoal briquettes could be dropped onto it. “Because lava rock is pretty dark, the thing that defines the volcanic cone, that shows its shape and makes it interesting, is the stuff bouncing off of it. That’s what we were aiming to get practically. We heated up barbecue coals and filmed them indoors, dropping them from a height onto the blackwrap to capture an element of tiny glowing, sparking embers.”

Rivulets of lava running down the sides of the volcanic cone were also photographed separately on an indoor stage, using a specially constructed surface to channel the lava into random, irregular flow paths. “The UV material just didn’t lend itself toward flowing in rivulets down our cone models,” said Beck. “So we built a shallower, generic surface that allowed us to control the angle and lighting better, and made channels on it out of clay.” The shots would later undergo heavy massaging in digital postproduction.

While the miniature unit in Santa Monica was immersed – quite literally – in volcano and lava effects, another unit was at work in San Bernardino on a massive miniature set for Volcano’s concluding scenes. In the storyline, emergency crews have succeeded in stopping the lava flow on Wilshire Boulevard. But a new threat emerges as Roark and Barnes discover a larger flow streaming its way through subway tunnels toward the Beverly Center Mall and nearby Cedars Sinai Medical Center. For effects scenes involving the Beverly Center, John Stirber and his Stirber Visual Network crew built a set representing a section of the city between San Vicente and La Cienega, and Beverly Boulevard and Fat Burger, the landmark fast food establishment. In addition to replicas of real

buildings, a fictional high-rise complex – the Beverly Tower – was constructed and subsequently blown up for the explosive finale.

Stirber and his crew began by taking detailed measurements, video and photographs of the real city blocks to use as reference in building their models. Upon returning to their studio, they developed the photos – roughly 10,000 of them – and mounted them on boards to form a picture puzzle of the streets they had to duplicate. Photographs and measurements were also compared with city blueprints and aerial images provided by the first unit. “We started designing in tenth scale,” Stirber explained. “Then Dave Drzewiecki requested that, for the sake of camera depth of field, the streets be widened to eighth scale-which increased the size of the set even more.” Eventually covering 21,000 square feet, the mammoth set would surpass the storage capacity of Stirber’s 12,000-square-foot shop. “Our plan was to build everything here, then transport pieces to a larger venue for filming. But figuring out what to build first and where to put it was a puzzle. Just the parking structure for Cedars Sinai Medical Center took up the whole length of our shop. The Beverly Center, which ended up measuring sixty-eight feet long and sixty-three feet wide, was simply too big for our shop – we had to cut it down, taking approximately thirty feet off its real dimensions.”

Not only was storage a problem, so was finding an indoor location for shooting. “From the very beginning,” remarked Drzewiecki, “we had argued that the miniature be shot indoors. For one thing, the buildings were extremely fragile, and since we knew the shoot would probably go on for weeks, if we had rain – which was likely in December – the model would be ruined.” With the often-used hangars at Van Nuys Airport already taken by *Dante’s Peak*, location scouts turned inland to Norton Air Force Base, near San Bernardino, where two large hangars were rented. But even the massive hangars were barely big enough to house the entire 200-foot-long miniature, assembled atop a four-foot-tall platform to accommodate pyro effects and camera snorkels.



Determined emergency forces make a last stand against the advancing lava in a multi-element composite, incorporating miniature lava, assembled by Light Matters.

At film’s climax, in a desperate bid to save lives, Roark and Barnes devise a plan to create a trench that will direct the lava flow into a storm drainage channel and out to sea by blowing up much of La Cienega Boulevard near the Beverly Center. To facilitate the series of massive street explosions, Stirber and his crew dug a cavity along the center aisle of the set and covered it with inch-and-a-half-thick breakaway plaster pieces. The Viskocil pyrotechnic team then wired it with seven-inch ring primacord. “We blew the street in sequence, starting from the far end and finishing with the Beverly Tower model,” said Viskocil. “For each shot we shattered two-foot sections of the plaster, two at a time. Underneath the plaster we also had miniature air cannons blowing up debris. To keep it from looking too dry, we added flash bulbs and a little gasoline.”

After each take, the Stirber crew redressed the entire set in ash – a lengthy process since, for most takes, every inch had to be covered. “The hard part was trying to match the ash that first unit created,” Stirber remarked. “We started out with a gray polyurethane material, but it didn’t create enough definition in the roadways. The director wanted to see banks and mounds of ash – but the more we tried to build those, the worse they looked.”

Contemplating the problem for days, Stirber finally hit on a solution late one night. He took a broom, cleared a small area of the set and experimented with gray snow flocking, spraying it onto the buildings and streets. To simulate tire tracks, he knelt on a furniture dolly and pulled himself through the set, using his knuckles to avoid tearing the flocking material. “We eventually got it down to a system. After the crews were done prepping a shot, we’d chase them out and re-flock the set. When it dried – in about thirty minutes – we’d send in three or four people on carts. There were a lot of sore knuckles.”

The downing of the Beverly Tower – a last-ditch effort to block the flow and divert it into the channel – was the final scene filmed on the miniature set. The model, comprised of a glass tower and an adjacent skyscraper made of breakaway concrete, stood on supports rigged to collapse onto themselves, then topple onto an exact mark. To achieve the controlled fall, Stirber employed a system he had used successfully on *Escape from L.A.* “Imagine standing with your back to someone who takes his hand and hits you behind the knee,” explained Stirber. “You collapse. That was the basis for our system. It consisted of a five-inch pipe, about a half-inch thick, cut in two at a sixty-degree angle. The two pieces sat on top of each other, and were kept from slipping apart by a spring-loaded steel bar and a series of safety devices. When the bar was removed and the safeties disengaged, the pipe fell like a guillotine.”

In addition to the weak-knee mechanisms, the floors of both buildings were hinged, causing each floor to collapse the next one as it fell. The first two stories of the larger tower were made entirely of glass. Structural supports began on the fifth floor and were there mainly to hold the building’s nine hundred tiny glass windows in place. As the Stirber team set each glass window, a Viskocil pyrotechnic crew would follow, laying in squibs to shatter each of the small panes of tempered glass. The second building, made of breakaway concrete, consisted of 1200 individual stones, each scored just prior to the collapse.

Safety was of paramount concern in planning the hair-trigger stunt. “We had people working around the model all day,” said Stirber, “so we had to be especially careful. We doubled the amount of safety mechanisms we’d normally use and didn’t release that last bar until the cameras rolled. That was done by a team of four guys, each working a levered arm attached by wires to the safety bars on the other side of the set.” To enhance the collapse, each floor was filled with debris. In addition, the top of the building was covered with dust so that it created a cloud as it fell. Squibs placed in the ash at the bottom of the building produced their own small clouds. The collapse was



Light Matters augmented real helicopters with digital ones for shots in which tons of water are dropped on the lava to cool it and stop its flow.

filmed twice, with a week between the first and second takes – just time enough for Stirber Visual to assemble another model. For the second take, a breezeway was added to connect the two buildings so that they would appear as one.

In the early stages of Volcano's conceptual and technical development, even before the miniature unit had begun its work, two companies – VIFX and Light Matters – had been tasked with devising digital solutions for the picture's key effects. They would be joined by Pacific Ocean Post and – in the postproduction compositing crunch – by Digital Magic and Digiscope. Although Beck would end up relying more heavily on practical effects than had originally been anticipated, the collaborative work of the digital vendors would prove invaluable. Ultimately, the digital teams would help shape the look and aesthetic of the shots through the massaging and manipulation of both practical and computer generated elements.

Driving the creative process for the development of digital lava was Light Matters. Of the sixty-four shots contributed by the company, twenty would feature digital lava or lava bombs. "We began our testing in Alias/Wavefront," recalled Colin Strause, 3-D supervisor in charge of lava creation. "We tried procedural lava, with math formulas defining the crust; but that looked too much like a digital effect. What we ended up with was a digital structure that was flat on top with a rounded front edge, moving across the ground like a big wedge. The surface combined a texture map – created from photographed images of the miniature lava to ensure a unified look-with a procedural program. To make the lava look like it was rolling over itself, we laid the textured surface and crust over the top of the wedge shape, timed to move with it. We key-framed by hand to set the front edge position, then used warp lights to give the surface an organic, oozing look."

While a majority of the 100-plus lava shots in Volcano would feature lava created by the miniature team, CG lava would be utilized for shots that could not be realized through practical means. "For example," Beck explained, "the aerial views looking down on the Wilshire set were done with CG lava. We were in a helicopter, flying over the set, bouncing around in convection currents. It would have been impossible to match that movement with a motion control camera flying over a miniature set." Digital lava also replaced its miniature counterpart in shots where there were problems with depth of field. "When we were looking along the surface at an oblique angle, it was hard to keep everything in focus. So in some instances, Colin just whipped up some in-focus CG lava, using the miniature lava as reference."

Two shots of lava moving through the subway tunnel toward the camera were also computer generated. "We tried those on a miniature set," related Beck, "but ran up against our 'two-knuckle' rule, which stated that if the lava was more than two knuckles deep on the miniature set, it wasn't going to look right. At that depth, we couldn't get enough light into it and through it to give it the luminous quality we needed. We ended up combining the CG lava with a really terrific flame element shot on stage; and, together, they made for good synergy." While miniature was the lava-of-choice for most leading-edge shots in which the flow could be seen moving toward camera, digitally rendered leading-edge lava, developed by Light Matters, replaced it for several low-angle closeups in which the curving front edge of the lava was extremely close to camera. "In those instances, we were pushing the miniature technique further than it could go."

Light Matters also devised CG lava bombs, seen speeding comet-like through the air and smashing into billboards, vehicles, apartments and streets. “The hardest part wasn’t doing the bombs, but the smoke that comes off them,” commented Strause. “In reality, with something that hot, the only smoke you would see would be steam caused by water in the air. But the production wanted a more dramatic look.” Working in Alias/Wavefront, Strause began by building the bomb as an egg-shaped object, animating its trajectory, speed and timing for production approval. “We generated a particle system to shoot a bunch of pieces off the bomb, and used a blobby tool to get the pieces to merge like drops of water. Then we applied a cloud-like shader to the bobbies to create the thick smoke. It wasn’t scientifically accurate, but it looked cool.” Strause completed the effect by adding specks of orange color inside the main mass and lighting the bombs to match the background plates.



The miniature effects team films a geyser of methocel lava spewed skyward by air cannons.

Working hand in hand with Light Matters was VIFX, which produced CG lava for one shot, as well as digital lava bombs for some of the eighty shots under its jurisdiction. Additionally, the VIFX team was responsible for developing digital leading-edge flame and smoke effects, used in conjunction with real flame elements to enhance the miniature lava flows. "Very early on," remarked VIFX visual effects supervisor John Wash, "we saw the need for a CG solution to some of the leading-edge effects. The miniature lava was terrific; but it wasn't connected to the street, with flames and smoke licking up from the surface. A lot of that was done in CG and had to be integrated with the miniature work." Digital supervisor Max Ivins and CG supervisor Antoine Durr generated a pipeline for rotoscoping the edges of the miniature lava elements. "Because we would be animating the edges," related Durr, "we could not just paint them. We had to remake the scene in roughly the same coordinates, then animate the leading edge along a ground plane as a basis for the flame."

From there, the work was handed off to digital artist Tomas Rosenfeldt, who developed the flame elements through a combination of procedural geometry, particle systems and shaders. "The whole idea behind doing computer generated flame and smoke was to save ourselves the hassle of having to shoot practical elements for every shot," stated Rosenfeldt. "That way, production did not have to deal with scale issues or the intensity of the flames or how many flames there should be. We came up with a fairly automatic system. Once the edges of the practical lava were rotoed, procedural geometry and particle systems emitting from the leading edge were rendered using our flame and smoke shaders, making the lava flow look and act as if it were generating fire and smoke along its intersection with the ground. We made the flames come up in a random way over the leading edge, so they wouldn't look too regular. We also developed a particle system for wide shots of the ash cloud, since the production couldn't supply anything practical that looked believable at such a distance."



The lava geyser was composited into a live-action plate of the Beverly Center by Digiscope.

Among the most challenging of the shots contributed by VIFX was a series of closeups revealing the eruption of the volcano. Digital artists John Heller and Mark Felt layered in more than thirty elements in creating the final composites. Using Silicon Grail's Chalice package, Heller built up the volcano using methylcellulose 'spluge' elements, a cloud tank layer of ash and rivulets of lava running down the rim of the cone. "We did a series of concept illustrations based on a lot of reference material we collected of lava cones, spluges and clouds," explained digital art supervisor Alison Yerxa, "and those were used in discussions we had with Mat Beck and Mick Jackson to nail down the direction we needed to go in."



A replica of the Beverly Center was constructed by Stirber Visual Network and photographed in a hangar for a climactic scene in which a high-rise building is demolished in order to direct the lava flow toward the sea.

Digital artist Ken Berland devised a computer generated cone model for distant shots of the volcano, using scanned-in photos of actual lava rock obtained from an ornamental stone company and applied as a texture map. "We changed the color of it, warped it, distorted it and pasted it over the top of the model. Then, since we wanted it to look like lava that has just begun to harden, we used two software packages. Matador and Photoshop, to do a lot of underpainting so you could see through to the layers of hot magma underneath."

For two master aerial views of the full-size Wilshire set, both Light Matters and VIFX created digital helicopters to supplement four real ones seen dropping water onto the contained lava. "Those shots were a real technical challenge," said Beck, "featuring more than 130 layers that included not only CG helicopters, but CG reconstructions of portions of the set, CG steam and a multitude of other digitally manipulated elements."

In postproduction, all of the digital companies would participate in the enormous compositing task, layering, on average, thirty to forty elements for nearly every shot. "Almost all of the shots in this movie had to be manipulated digitally, with complexity added," stated Beck, alluding to work that ranged from massaging practical elements to layering in digitally generated smoke, flame and ash. "Color correction was also an issue, since UV lights on the miniature lava flows sometimes created strange banding issues, turning sections of the lava odd colors."

Pacific Ocean Post – under visual effects supervisor Stuart Robertson and effects producers Mark Brown and Andrea D'Amico – served as a clearing house and quality control center for the postproduction work, scanning and recording all the shots to ensure image consistency. POP also contributed nearly fifty effects shots to the mix. "Volcano was notable in that the postproduction process relied heavily on the abilities of digital effects artists to create the look and aesthetic of each shot," noted Robertson. "Mat would bring us a list of elements that seemed like good candidates for use in a shot, then say to our artists: 'Show me what you can do with these.' On Cineon and Inferno workstations, our artists employed a full gamut of techniques to reshape and reanimate lava, pyro and background elements provided. In addition, our CG supervisors, Matt Hightower and

Barry Robertson, produced smoke, ash and flame elements to augment the production elements for almost every shot.”

Among key scenes contributed by POP was a six-shot sequence in which lava advances on a subway train stranded in a tunnel. As the flowing lava engulfs the train, MTA chief Stan Olber (John Carroll Lynch) sacrifices himself to rescue an injured engineer – dragging the unconscious man to a platform at the rear of the train and throwing him to safety seconds before his own fiery death.

The sequence would go through more than a dozen iterations before a final look was achieved. “Like many of the scenes we worked on,” observed Robertson, “this one required a lot of creative input from our artists. We had to figure out where the fire would be on the train, how much fire there would be and what color, the speed of the lava flow, how far along the track it would advance, how it would bend over the different pieces, and so on.” Lead digital artists Adam Howard, Jennifer German and David Crawford painted out portions of the live-?/ action tunnel set, adding lava elements, fire to the outside of the lava, and pyro to the train itself. “We applied a lot of paint and warp techniques to the miniature lava and did extensive reshaping of it to make it match our painted tunnel floor.” To capture Olber’s demise, the production had filmed a stunt-man descending on an elevator rig into a trench rigged with pyro. “In postproduction, the elevator rig and lights illuminating it all had to be replaced by paint so that the character appeared to be sinking into the lava. Then we rotoscoped him around the lava he was falling through.” Face replacement on the stuntman – who wore a protective mask – completed the effect.

After months of scrambling to meet tight production deadlines, Fox would end up postponing *Volcano*’s release until two months after the opening of *Dante’s Peak*. But even though a preemptive strike at the boxoffice was not in the cards, audiences responded with delight to the big burns and realistic lava effects when the film finally opened on April 25. “When we started out,” said Mat Beck, “it was kind of an act of faith. We all just plunged in with a lot of highly motivated and talented people, not knowing how we were going to solve most of our problems. Not only was there no time to develop techniques before the movie was approved, we did not even have the luxury of developing them before the start of principal photography. So we were literally doing preproduction, production and postproduction all at the same time. In a way, it was like being asked to run a quarter-mile race; and after you’ve run it, you’re told: ‘Well, you know, it’s actually a mile race – and you have to do it in world record time.’ There were huge numbers of dedicated people out there working in the trenches as hard as they could on a very tight schedule. In the end, they prevailed. Not only did we survive – I think we won the day.”

Volcano photographs copyright ©1997 by Twentieth Century Fox Film Corporation. All rights reserved. Effects still photography by Randy Kwan, Eric Swenson and Sam Urdank. Additional photos courtesy of Mat Beck, David Drzewiecki and Kevin Yagher. Special thanks to Scott Shields.

With a Little Help From Our Friends

image

article by
Jody Duncan



*Fortuitous pairings with Todd McFarlane and New Line Cinema led to the film directing debut of Industrial Light & Magic computer wiz Mark Dippé. The vehicle was *Spawn*, a movie based on McFarlane's phenomenally successful comic book series about a tragic superhero. Dippé confers with title-role actor Michael Jai White.*



*Delving into *Spawn*'s past, the film depicts the murder of government assassin Al Simmons and his ultimate return to the living after striking a deal with a devil. Disfigured by his fiery death, Simmons witnesses his young daughter's birthday party from afar.*



As Spawn, Simmons is endowed with supernatural powers, and can summon a magical, protective armor at will.

It was late one night, nearly a decade ago, when Mark Dippé and Steve ‘Spaz’ Williams – two of the most promising young artists in Industrial Light & Magic’s then eight-person digital department – partook a bit too generously of alcoholic beverages and decided to explore George Lucas’ offices at Skywalker Ranch without invitation. The result of this lapse in judgment was that they were banned from the ranch for a full year.

Despite this inauspicious beginning – and many subsequent acts of rebellion – the undeniably talented twosome went on to thrive at ILM, supervising the visual effects for major motion pictures and branching out into commercial directing, often working closely with visual effects producer Clint Goldman, another brash and outspoken youth who had charged his way up the ILM ranks. Even as their careers within the visual effects field blossomed, however, all three men were dreaming bigger dreams. “Clint and Spaz and I became comrades,” Mark Dippé explained, “and, about five years ago, we got to a point where we said: ‘Enough of this. It’s time we did our own thing.’ ILM was a great place to be, but we were determined to make our own films. We knew people in the business and we had the skills – all we needed was the opportunity.”

Opportunity came as a result of two simultaneous, yet unrelated events. In 1992, Dippé, Goldman and Williams met and befriended Todd McFarlane, a kindred spirit from the comic book world who had left giant Marvel Comics, started his own company, and promptly created *Spawn*, soon the best-selling comic book in America. At the same time, Goldman and Williams were producing and supervising, respectively, ILM’s 3-D animation effects for New Line Cinema’s *The Mask*, making a favorable impression on New Line executive Michael DeLuca.

As *Spawn* grew in popularity, so did studio interest in developing a movie deal with its creator.

Determined, however, to have some creative influence in the production of such a film, McFarlane



KNB EFX Group crew member Garrett Immel and co-founder Howard Berger fit White into one of many *Spawn* suits created by the company.



The transformation of Simmons into *Spawn* included full head armor, also fashioned by KNB. When angered, *Spawn* displays glowing, smoking eyes, an effect achieved digitally by Jamie Dixon at Hammerhead.

balked at heavy-handed, big-studio offers; and more than one development deal soured. “Todd didn’t want to just hand his baby over to some big studio without having any say as to what happened with it,” explained Clint Goldman. “So I mentioned that DeLuca was a good guy who knew comics, and I told Todd that he could probably make the movie he wanted to make at New Line – especially if Mark directed it and I produced it. And Todd said: ‘Do it. It’s yours.’ It was just that fast; and he stuck by that. Even when his powerful lawyer told him not to work with us and not to do the movie at New Line, he stuck by us. He fired his lawyer and put the deal with New Line together himself.”

Still laboring at their day jobs at ILM, Goldman and Dippé set about developing *Spawn* during their off hours. Dippé wrote an initial story treatment, then worked with screenwriter Alan McElroy for a year and a half to arrive at a polished, completed screenplay. “We also began some design work for the movie,” said Dippé, “still working on our ILM projects the whole time. We would work on *Spawn* during weekends and at night.” Once New Line officially optioned Dippé’s story, money finally became available to bring on storyboard artists. “We kept making the story better and the designs better all through this development stage; but it went very slowly, and still the movie had not been greenlighted. We were just generating all of this stuff on our own.” As 1995 rolled into 1996, Goldman, Dippé and Williams knew that they had taken *Spawn*’s development as far as it could go. “We’d done a lot of storyboarding, design work, and effects design. We were ready; and we told New Line that it was time to do it. The film was greenlighted a month later, and we came down to LA to get a crew together.”

Among the tasks accomplished during the two-month period leading up to the August 13 start of principal photography was the commissioning of facilities to produce *Spawn*’s effects – which, due to a production budget of only \$39 million, had been set at a relatively meager eighty shots. Those were divided between ILM, where the movie’s 3-D animation shots would be realized, and Banned From the Ranch Entertainment – ironically, a company named in honor of the infamous Dippé-Williams episode – which was assigned 2-D and compositing chores.

It was a humble beginning – a modest budget and an economized effects slate. But before it was done, the initial budget would be increased dramatically, the number of effects shots would quadruple, and a total of twenty-one effects companies would be credited, nearly every one staffed by people who had worked in the effects trenches with the creative trio. To a man and woman, those artists and technicians were unfailingly generous and enthusiastic in their efforts to come through for a project in which, finally, three of their own were in the driver’s seat of major motion picture production.

As scripted by Dippé and McElroy, *Spawn* examines the back story of McFarlane’s antihero. Al Simmons (Michael Jai White) is a highly effective government assassin whose own murder is contracted by his superior, Jason Wynn (Martin Sheen), when he tires of the killing and decides to leave the secret agency. Killed in a massive explosion at a biochemical plant, Simmons descends into hell where he strikes a deal with the devil Malebolgia: in exchange for being resurrected and returned to earth to see his beloved wife Wanda (Theresa Randle), Simmons agrees to lead Malebolgia’s army in storming the gates of heaven. *Spawn* is born – a supernatural creature whose burnt and charred flesh takes on a protective armor at will, and who is aided in battle by magical blades and a cape that alters shape and function at his command. Torn between the forces of good

and evil – represented in the characters of Cogliostro (Nicol Williamson) and Clown (John Leguizamo), respectively – *Spawn* ultimately faces both his internal and external demons and vows to fight hell's forces on earth.

Although the majority of the movie's effects work would be created in its seven-month-long postproduction – an extended post that the effects-savvy filmmakers had vehemently fought for – makeup and animatronic effects were required on set throughout much of the three and a half months of principal photography on locations near Los Angeles and on the stages at Hollywood Center and Raleigh Studios. KNB EFX Group was responsible for designing and producing suits and prosthetic makeups for the *Spawn* and Clown characters, as well as building various versions of the Violator – Clown's monster incarnation – and a Malebolgia rod puppet.

For the postmortem Simmons character alone, the company had to create both full-body and head-and-chest charred flesh prosthetics. “We did a full-body ‘burnt Simmons’ makeup for shots of Simmons in hell, where he appears nude,” explained KNB co-founder Howard Berger. “The suit, including head and hands, was sculpted by Norman Cabrera, working from a life-cast of Michael Jai White. We sculpted several maquettes before settling on the final look.” A separate makeup was devised for Simmons after his return from hell. “He is still severely burned, but his burns have healed somewhat. That was a full head-and-shoulders appliance makeup, as well as hands, chest, dentures, and contacts to make his eyes lighter.” On the set, the makeups were applied by Berger and makeup artists Gino Acevedo and Garrett Immel.

Suits and helmets fabricated by KNB created the look of *Spawn* in his full head-and-body armor, or in the body armor alone. “Mark asked for both an ‘at rest’ suit and a battle suit,” explained Berger. “There is very little difference between the two; but if you put them side by side, you can see it. The battle suit has a more dynamic-looking design on the chest, spikes and a more defined, intensified muscle structure.” Separate gloves were also designed and created for the rest suit and the battle suit, as were separate heads. “The rest head was less extreme and intensified in its look, while the battle head had a stronger jaw line, slanted eyes and an angry, vicious look.”

Throughout the movie, *Spawn* is taunted by Clown, a grotesque emissary from the underworld. KNB's primary challenge in creating a makeup for Clown was that actor John Leguizamo did not physically resemble the short, squatty character at all. “Clown is this big, fat, disgusting party clown from hell,” Berger said, “and John Leguizamo is a really slim guy of fairly average height. So we had to do a whole number on him to turn him into Clown. Our biggest concern was the height; but John was able to squish himself down and pull that off physically. We did a full appliance makeup on him, including contact lenses and teeth, and put him in a fat suit that was made out of polyurethane foam and weighed a good fifty pounds. It was weighted down with lead shot so that it would jiggle in the breast area.” To insure that the suit and makeup did not restrict Leguizamo's very physical performance, KNB brought the actor in for multiple fittings as pieces were designed and fabricated. “Anything that bothered him, we modified. We actually sculpted the makeup twice. John felt that our first attempt was too restrictive, with too much rubber on his lips. So we resculpted it, and it worked out much better. John was just magnificent in that makeup.” Consisting of multiple foam latex prosthetic pieces, the makeup was applied on set by David Anderson and Greg Funk in a three-and-a-half-hour procedure.

Early in the film, the malevolent but physically unthreatening Clown reveals a more horrific form, transforming into the twelve-foot-tall reptilian Violator. Featured in battle sequences with *Spawn*, most of the Violator shots would be achieved with a computer generated character, animated by ILM. But to avoid the need for a costly CG solution to every shot of the beast, KNB was commissioned to build a full-size animatronic puppet that could be filmed either on set or against bluescreen.

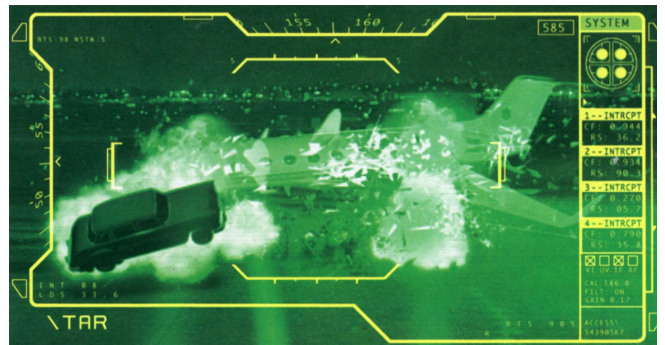
Designs for the Violator had been evolving at ILM since early in the production schedule, with effects art directors John Bell, Ty Ellingson and Scott Leberecht doing renderings to translate McFarlane's stylized 2-D art into something that could be realized in three dimensions. Berger and his KNB team grappled with the same problem as they began to design and build their full-scale Violator. "The Violator, as drawn, was not a practical thing to build," noted Berger. "So we kept modifying it in a series of maquettes, incorporating comments we got from Mark Dippé and Steve Williams. Violator went through six weeks of development before we had an approved maquette."

The twenty-four-inch maquette was translated into a full-size sculpture, from which KNB built three Violators: a full-body rod puppet for stunts; a cable-operated upper torso; and a hero, hydraulically-driven upper torso. The hydraulic puppet sat on a cart that housed a computerized operating system, compressors for the hydraulic pumps, and a series of joystick controllers. "Most of the time, the cart was bluescreened or framed out of the shot," stated Berger. "It took five people to operate it. One person operated the arms and fingers; another the gross movement of the body; a third was on the head and the mouth; and two RC guys operated the facial expressions."

All three versions of the Violator had mechanical frames that were fitted into fiberglass shells, then covered in foam latex skins painted in grays and browns by Gino Acevedo to suggest a reptilian texture. Bulbs inside the creature's eyes created a red glow, while water pumped through tubes provided a continuous flow of drool. "We thought of using methocel or something thicker for the drool," Berger remarked, "but spraying a tremendous volume of water proved to read better on film."



The film opens at a military air base in Hong Kong, where a parked jetliner carries Simmons' latest assassination target. Both the target and innocent victims are marked for death as the dispassionate and amoral Simmons launches a rocket toward the aircraft. Starting only with a static live-action plate of the plane, Banned From the Ranch Entertainment computer generated the rocket, as well as surrounding jetways, trucks and planes.



BFTR also animated the subsequent explosion and created graphics displays to suggest Simmons' view of the carnage through high-tech night-vision goggles.

Steve Williams directed the Violator puppet bluescreen shoot over the course of two weeks. “KNB’s stuff worked really well,” Williams-noted, “but we knew from the beginning that to get wide shots and interactive stuff, like Violator lifting *Spawn* off the ground and shaking him, we’d need a CG Violator, also. As it turned out, we ended up just using the hero hydraulic version for insert pieces. But those were important because they saved us from having to do even more CG Violator shots.”

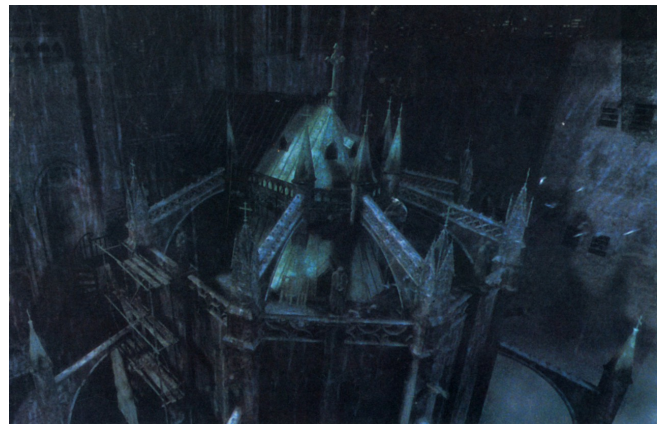
While most of the effects work at ILM and Banned From the Ranch would be executed during postproduction, both companies were gearing up for the project throughout principal photography. The prep time was especially beneficial to BFTR, since it afforded the company – which, up to now, had specialized in creating on-screen computer and video display graphics – the opportunity to do previsualizations for its first-ever >film resolution visual effects assignment. “We were set up for doing film rez effects,” explained Van Ling, who founded the company with producer Casey Cannon in 1995, “because a lot of our screen graphics work on projects such as *Dante’s Peak* and *Twister* were done at half high-rez, anyway. So we were already halfway toward doing computer graphics at film rez. Mark and Clint decided to go with us for the smaller cleanup effects, such as flat 2-D composites and some morphing – fairly minor stuff that wouldn’t have made sense to pay ILM to do. We were going to do about two dozen of those shots, in addition to all of the playback graphics.”

But BFTR’s role in *Spawn* expanded when Ling and his crew took the initiative and reconceived some of those minor utility shots as full-blown effects. “Mark and Clint had tailored these shots to keep them small and low-budget,” said Ling, “but we all felt that they should be more. We didn’t want to have huge, amazing ILM shots cutting to our low-budget shots. We wanted our stuff to measure up to the caliber of the other effects in the show. So we suggested that we do more than just utility shots; and we started doing previsualizations on some of them, with texture-mapping and everything. That showed that we could do more than just straight composites and utility effects, and that we had an eye for filmmaking and for storytelling.”

The BFTR team initiated its *Spawn* assignment with a series of ‘gullet’ shots representing Simmons’ descent into hell. “He falls through this big tube of fire,” explained lead digital artist Erich Ippen, “and he is on fire himself. Taking cues from previz stuff that Van had done, I created some very simple geometries, mapping textures we’d created from fire elements onto them.” The plan was to composite bluescreen elements of *Spawn* into the gullet environment. But, again, BFTR took the initiative and convinced Goldman and Dippé that they could



Having determined to leave the secret government agency, Simmons becomes its next casualty when his superiors orchestrate his murder in a fiery explosion. After his death, Simmons descends into hell, a surreal digital environment created by Santa Barbara Studios.



execute better control of the sequence via a computer animated *Spawn*. Ippen animated the 3-D character, adding camera moves to create a more dynamic fall. “The camera starts out looking up at him as he falls toward it, then snaps down to see him falling away. I did all of this on the Macintosh – my 3-D work was done in Electric Image; the movie textures were done in AfterEffects; and still textures were done in Photoshop.”

In addition to the gullet shots, BFTR produced a series of images for the movie’s climax, a final showdown between *Spawn* and hell’s demons that takes place in the home of his former wife, Wanda. There, a living room fireplace serves as a portal to and from hell; and with each entrance and exit, the fire burning within the fireplace explodes into the room. Background plates provided to BFTR featured only the practical fire within the fireplace, rigged with nozzles to surge upward on cue. Flame bars were also set up off-camera to provide interactive lighting on the characters. The more explosive, choreographed action of the fire fell to BFTR. “There were about five fireplace shots altogether,” said Ippen. “The challenge was just getting the fire to behave appropriately since, generally, fire doesn’t want to do anything except rise. But in these shots, it had to explode out of the fireplace, either spit something out or grab someone, and get pulled back in. To do that, we used fire elements that we had shot, distorting them and animating them in 2-D. We also took some of those fire elements and mapped them onto 3-D objects to make them behave in specific ways, such as curving around objects in the set. There was even some synthetic fire that I created entirely in AfterEffects.”

A large percentage of BFTR’s effects shots served to simulate wounds suffered by *Spawn* in his confrontations with Wynn and other evil forces. Bullet hits, for example, create holes in the superhero’s clothing and flesh; but, rather than spurting blood, the openings reveal glowing green energy – what Clown refers to as ‘necroplasm’ – before closing up and healing. Since little had been done to suggest the effect practically on the set, the wound shots had to be created entirely in postproduction. Digital artist Greg Notzelman developed a technique for producing the green-glowing wounds, basing them on previsualizations executed by Ling and Ippen. “We started with a neck wound seen later in the movie,” said Notzelman, “which, since it was a closeup, had to be very detailed. We figured that by getting that shot down, we could define the look for all of the wound shots. It evolved into a neck wound with tendrils coming out of it, and burns and bubbles around it, with green energy moving inside. We wanted it to have a physical quality, so it wouldn’t look like a morph or some other pasted-on element.”

“One of the things Greg pioneered for the wounds,” Ling explained, “was a kind of ‘two-and-a-half-D’ effect, creating the sense of 3-D by using a lot of complex layers of 2-D elements. There had to be some 3-D qualities to them, because there were camera moves on these shots. Also, the wounds were supposed to have a lot of light coming out of them; and light wraps around 3-D objects in ways that you can’t manipulate as well on a flat-painted surface. I think we were able to achieve that sense of 3-D – but we did it all with 2-D layers.”

Spawn’s supernatural healing powers are first revealed after a gunfight within an embassy ballroom. Not only was the character to be riddled with bullet wounds in the scene, the action leading up to

By far the most difficult shot to create was the final showdown between *Spawn* and hell’s demons in the home of his former wife, Wanda. There, a living room fireplace serves as a portal to and from hell; and with each entrance and exit, the fire burning within the fireplace explodes into the room. Background plates provided to BFTR featured only the practical fire within the fireplace, rigged with nozzles to surge upward on cue. Flame bars were also set up off-camera to provide interactive lighting on the characters. The more explosive, choreographed action of the fire fell to BFTR. “There were about five fireplace shots altogether,” said Ippen. “The challenge was just getting the fire to behave appropriately since, generally, fire doesn’t want to do anything except rise. But in these shots, it had to explode out of the fireplace, either spit something out or grab someone, and get pulled back in. To do that, we used fire elements that we had shot, distorting them and animating them in 2-D. We also took some of those fire elements and mapped them onto 3-D objects to make them behave in specific ways, such as curving around objects in the set. There was even some synthetic fire that I created entirely in AfterEffects.”

the healing effect featured a long Steadicam shot of Michael Jai White stumbling toward and into a kitchen, increasing the difficulty of tracking the multiple glowing green wounds to his character. “I had to take what Greg had done with the wounds,” observed digital artist Steve Walker, who did the tracking shot, “and try to recreate that throughout this long, complex shot. Using Electric Image, I created a 3-D model of *Spawn*’s torso, and tracked the camera movement to that. Then I took it into AfterEffects to render the wounds.”

“Steve also built a 3-D environment, based on the plate,” related Ling, “so that he could put in reflections as *Spawn* goes through the metal kitchen doors. Because there is so much green light coming from these things, it wasn’t just a matter of modeling the wounds or the characters; a lot of the shots also involved modeling the surrounding environments so that we could put in interactive light that wasn’t on the set.”

The greatest concentration of BFTR’s effects work is in the movie’s opening moments, as Simmons dispatches his latest assignment at an airport, using a hand-held missile launcher to blow up a parked plane. Airport regulations had prevented production from creating any kind of real explosion; so what was delivered to BFTR was a plate that featured only a short zoom-in on a plane sitting on the tarmac. “We had nothing but that shot of the plane,” Ling said, “with a couple of extras pretending to dive out of the way of the explosion and a big orange light coming up on it. Production originally figured they would just comp an explosion on top of that plate – but we felt we could do better than that. So we ended up modeling parts of the plane and flipping cars in the foreground – really making it feel as if the explosion was there, happening.” For a dynamic shot of the missile approaching the aircraft, Steve Walker created the entire airport area – planes, trucks, jetways and tarmac – in CG, then animated the missile and its trails streaking towards the static live-action plate, which was placed like a billboard at the far end of the CG environment.

In the same sequence, an airport control tower explodes, the result of Simmons’ detonation of a bomb to destroy evidence of his clandestine activity. Although an empty plate of the control tower gave BFTR something to start with, the tower itself was replaced by a CG version. “I began using the background plate for the shot,” stated Walker, “just compositing in the explosion. But after discussing it with Van, we decided to do it all in CG. The trick was to match up the CG tower as carefully as possible with the background plate.” Electric Image was implemented for the 3-D tower and missile work, as well as missile trails, smoke and debris.

The airport sequence also featured a number of shots representing Simmons’ POV via night-vision goggles – the kind of graphics displays and overlays on which BFTR had cut its teeth. “Mark wanted a sense that these were super high-tech night-scopes,” stated Ling, “so they needed that green night-vision look. But they also needed graphic overlays for auto-tracking and auto-targeting data. Wire-frame models were constructed to match all of the objects in the shots. Then they were tracked and given to me to composite. I took all of the wire-frames and had them pop on at the right times, adding camera motion to them so that it would feel as if a person was actually wearing the nightscope goggles.”

Rounding out the BFTR effects slate was a handful of grabbag shots, such as an establishing view of Cogliostro looking off into the city night as green clouds move overhead, suggesting turbulence in the spiritual world. The clouds were created entirely on the Macintosh. To impart a sense of

turbulence, Erich Ippen first generated a roiling cloud element using After-Effects' 2-D particle system. "I rendered that out as a movie and composited it into the scene," noted Ippen, "fading it out and scaling it and hand-animating it until it looked interesting. I did the same thing over and over again, until I had many layers of clouds rolling into the scene." The background was further sweetened by Bruce Walters of XO Digital Arts, who added futuristic, matte-painted elements to the live-action skyline.

BFTR also executed a transformation of Wanda into Clown employing a combination of Media Illusion and Elastic Reality on SGI and AfterEffects on Macintosh. "Almost all of our work on this show was Mac-based," asserted Ling. "The SGI was the support system in terms of providing us with matte elements and 3-D elements, but the majority of our shots were done at least partially on the Macintosh – and three-quarters of them were done entirely on the Macintosh."

As Banned From the Ranch labored on its effects, Industrial Light & Magic was preparing for approximately fifty 3-D animation shots, divided between visual effects co-supervisors Habib Zargarpour and Christophe Hery, with Steve Williams overseeing the entire effort. Early in the project, ILM art director Scott Leberecht took on the task of producing artwork to help define those effects. Included in Leberecht's work were renderings of *Spawn*'s magical cape, drawn onto live-action frames as plates began to arrive from production in Los Angeles. Although the *Spawn* suit built by KNB had included a cape that could be attached when needed, McFarlane and the filmmakers had determined that it would be more magical and visually interesting if a billowing CG cape was conjured up by *Spawn* as needed. Consequently, the practical cape was not used at all. Zargarpour oversaw approximately twenty shots in which the huge shape-changing cape was featured. "One of the things that struck me when I first looked at the comic book," Zargarpour remarked, "was the way the cape was drawn. It was always very geometric and abstract – not like a physical thing stuck on someone's back. And it was intriguing to see if we could bring that characteristic to life in the movie. We were shooting for really abstract concepts, where pieces of the cape would come off or disappear or change form. Mark Dippé wanted it to have a life of its own; and Todd McFarlane



In command of his new supernatural accouterments – which include a magical cape – Spawn confronts his superiors at an embassy reception, descending through a skylight in the ceiling.



Such dramatic and finely choreographed stunts required a digital representation of Spawn, created and computer animated by a team at Industrial Light & Magic. ILM also computer generated the shape-changing cape for both live-action and CG shots of Spawn. ILM's Spawn and cape wire-frame models are positioned within the live-action embassy plate.

described it as being not cloth and not armor, but something in between. He described it as something that looked very elegant, but if the edge touched your arm, it would cut it off.”

Zargarpour, lead technical director Mary Beth Haggerty and a team of animators collaborated on the cape shots, each of which required its own R&D since the cape needed to behave so differently from shot to shot – sometimes billowing, sometimes taking rigid forms such as a concrete wall or motorcycle armor. Despite the cape’s various shapes and sizes, only one three-dimensional cape model was built. That model was then roughly animated into each specific form. “We animated these large, flat sheets of cape into their broad positions,” recalled Zargarpour, “then took that animation through Dynamation to add the cloth simulation, using the forces of physics to help with the animation. If the cape had to unwind, for example, I used one of the vortex fields we had from *Twister* to help it along. Animation opened it up, but it was helped with these simulated forces of wind and turbulence. We just plugged them into Dynamation.” Despite such procedural aids, the cape still required a great deal of hand animation. “The closer the cape was to the attachment at *Spawn*’s collar, the stiffer it had to be. We manually assigned the stiffness of every point – and there were 6500 points. It was a very labor-intensive thing; but we eventually came up with techniques to make it easier, such as assigning the stiffness by rows.”

In addition to his cape, *Spawn* is aided by necroplasmic armor that emerges organically from his body. Conceptualizing how that armor should form was something Scott Leberecht sweated over for several weeks. “Nobody knew how this protective shield should appear and disappear,” recalled Leberecht. “The one thing we did know was that Mark wanted it to look and sound like armor, or a hard, protective shell. He wanted to avoid a soft, fleshy look, or anything that might look like a guy in a rubber suit. But the contradiction was that it was also living armor – something organic that could change shape and move around on his body.” To arrive at the concept, Leberecht did research, looking at reference material of insects with protective shells that were hard, yet organic. “We finally came up with armor made of plates that snapped into place, conforming exactly to the parts of his body.”

Execution of that concept was taken up by animation supervisor Dennis Turner, who spent some time developing a workable approach. “I ended up using patch deformations,” stated Turner. “I took all of these separate, mechanical armor pieces and laid them out in big rectangles. Then I patch-deformed them over his head or his arm or his torso – whatever it happened to be. So, each piece would



Spawn’s ‘necroplasmic’ armor enables him to conjure up chains, blades, claws and other weapons, as needed. The supernatural tools were computer generated in three dimensions by ILM, then tracked to the live-action photography of *Spawn*.



start out as a big square, then deform to *Spawn*'s contours. And even though it took on that organic shape, it still moved in a mechanical fashion."

For the appearance of either the body or head armor, a CG version of *Spawn* was needed. Because of the detail and expression inherent in a person's face, the animation of the CG head was particularly difficult.

"In one shot," explained Turner, "Violator has *Spawn* pinned, and he is licking his face to taunt him. *Spawn*'s face mask armor comes up to protect him, as a kind of reflexive action to the licking. In the plate, the actor was moving his head around quite a bit, as if trying to get away from the tongue. Our match-movers had to match all of that head movement; then we had to apply the armor to the match-moved CG head. There was quite a bit of animation involved in that, getting the tendons on his neck to stretch – all of the things the head does when you tip it way back. We had to match all of that because the shot goes from the live-action actor's head to the CG *Spawn* head to the CG armor head."

Similarly, spikes were animated and tracked to a CG representation of *Spawn* for scenes in which the weapons emerge from the character's armor. "Attaching digital prosthetics to a live-action actor is more difficult than doing the entire thing in CG," Turner commented, "because when you attach CG prosthetics, you can't afford to have any slippage between the CG element and the live element. There were so many CG prosthetics in this show, the match-moving was one of the most critical elements." Precision was so critical, in fact, chief match-move artist Lanny Cermak and crew used the fully articulated *Spawn* animation model to do their task, rather than simple human-shaped geometries. "Normally, match-movers are only dealing with placement; so they will use a very basic human form, almost like an artist's dummy, when they are putting in their match-moves. But on this show, they not only had to use the same CG model the animators used, they had to be extremely precise with the placement of that model as it related to the live-action actor in the plate. They had a much tougher than usual job on this show."

Spawn's armor also included chains that extend from his body on command. "The chains became a huge project because of the numbers involved," stated Zargarpour. "Some shots required eight hundred links. It would have taken Softimage an hour to evaluate a shot like that. So we took a whole different route, using particles. The animators just made splines; then we used Dynamation to create links that knew which direction to point and how to move, based on the rules we set up. Basically, we had one link that was randomized for scale and texture and position to create a whole chain of varying links."

CG *Spawn* was utilized in about forty animated shots of the character in battle, sustaining damage that could not be inflicted on either the actor or a stunt double. "The *Spawn* model was a challenge in the sense that it has always been difficult to do a human figure in CG," remarked chief modeling supervisor Stewart Lew. "That has been the Holy Grail of this industry. What was fun about *Spawn* was that we weren't just trying to do a regular human being, but a superhero character. *Spawn* did not have to look totally human; so we took some liberties with anatomy, such as in his musculature."

In addition to his belt, *Spawn* and *Spawn* is equipped with a belt buckle to hold his defense. Banned from the Rome's tools, *Spawn* is a character who is the assailant in the greenish, glowing energy, then close up and disappear. The 2-D effect – requiring extensive match-moves – was executed through digital paint and morphing techniques.

“The real challenge of creating a digital *Spawn* was matching the live-action suit, which was foam latex dressed with gel and water,” Zargarpour elaborated. “I worked on shaders to create that look. The other issue was his musculature. We used volume enveloping to make the skin slide over the musculature in areas such as the biceps and the pectorals. That really brought digital *Spawn* to life, which was important since we were often cutting from live-action *Spawn* to CG *Spawn*.”

For a scene in which *Spawn* walks out of flames after a highspeed chase ends in an explosion, Michael Jai White’s gait was motion-captured to provide a basis for the CG animation. “At first,” recalled Zargarpour, “we motion-captured Spaz, since it was just a simple walk. But that wasn’t working because you could tell it was Spaz. It was obvious, even from a simple walking gait, that it wasn’t Michael Jai White. So we had to actually bring the actor in and motion-capture him. Then we did some hand-animated cleanup afterwards in the hands and wrists.”

While digital *Spawn* presented all of the usual challenges of computer generating a human figure, Violator was exactly the kind of fantasy-based character that CG does best. KNB’s Violator maquette was scanned, and from that data, Stewart Lew built a computer model. Lead viewpainter Rebecca Heskes then created the creature’s skin texture. “We wanted a plated look on Violator,” explained Christophe Hery, “but very bumpy and organic, as well. We used a lot of displacement mapping for the details because we didn’t want to build a very heavy model. We wanted to be able to manage this model fairly quickly and easily; and by using displacement maps, we could keep the model more manageable. For example, in the rib cage of the Violator, you can see bones coming through, creating horizontal stripes on his torso. Rather than modeling the ribs, they were painted with these maps.” The animation of the character was both organic and somewhat mechanical. “We arrived at that look after a lot of trials and testing. And there are many details in the animation. You can see the rib cage pumping as Violator breathes and you can see his muscles bulging.”

Translucent goo emanating from the character’s mouth and extremities was a key characteristic of Violator. Water pumped through tubes had created the effect on the practical version; and Habib Zargarpour supervised the task of duplicating the look in CG, with lead technical director Mitch Deoudes doing the hands-on development. “In the past,” noted Hery, “when we needed to generate drool, we would shoot elements on stage and then texture-map them on flat patches. But this was actually 3-D drool, so you could put in real lighting and you could see it from any perspective you wanted. We took a big step in goo for *Spawn*.”

By far the most challenging shot for ILM was the 515-frame transformation of Clown into Violator, first visualized in Scott Leberecht’s concept renderings. “We didn’t want to do a universal morph,” remarked Leberecht, “a universal scaling up



In a confrontation between Spawn and Clown, the latter transforms into the powerful Violator. The majority of the film’s Violator shots were achieved with a digital model,

from the little Clown to the big Violator. We wanted it to look like the character was literally giving birth to himself in a transformation that was very violent and painful.”

To play up the depth and organic nature of the transformation, the background plate was shot with the camera rotating nearly 360 degrees around the mutating character. “There was no cheat allowed,” stated Hery. “On stage they rotated around a target – a pole with a tennis ball on top – with the camera on a crane. The idea was to show the transformation from every angle. That added difficulty to the animation; and of course it meant we couldn’t do any morphing, even just to help the transformation along, because morphing is a 2-D process.”

After some discussion as to whether or not the transformation should begin with some 2-D manipulation on the image of the live-action Clown, cross-dissolving to a digital version and then to the 3-D transformation, the ILM team decided to do the effect digitally throughout, starting with a CG Clown. Before a Clown model could be built, however, the digital artists had to figure out how to interpolate between that model and the Violator model that had been built early in production. “It looked almost impossible,” Hery admitted, “because these two characters had such different forms and sizes – one was very tall and spindly, while the other was very short and fat. Luckily, we had a modeling tool at ILM called Isculpt; and I thought that might allow us to take the Violator data and mold it into Clown, physically, as if it were clay.”

Modeler Wayne Kennedy set out to test the idea, but there were grave doubts within the digital team that such a modeling feat could be accomplished. “It just didn’t seem possible that we could take the Violator model and push it and reshape it into Clown,” Hery said. “But if it worked, it would be the best solution to doing this transformation. It would give us a one-to-one correlation between Clown and Violator, with the same number of points and the same chaining. So, instead of going from one model to a more transformed model to an even more transformed model, we would be able to do this whole transformation in one shot, without any cuts in between.”

Remarkably, the test proved promising, and Kennedy went on to build a Clown computer model that, transformer-style, could open up and unfold into the Violator. “Our Clown model was mathematically identical to the Violator,” Dennis Turner explained. “Piece for piece, patch for patch, geometry name for geometry name, it was identical. It was really quite a trick to smash and push and scale all of Violator’s CG bones until they finally fit within Clown’s frame. That was probably the biggest technical challenge of the whole show.”

With two mathematically identical models, the transformation from one to the other was a fairly simple animation task. “Once Wayne had the Clown model completed,” said Turner, “I brought it in with my Violator model so that I could apply various scalings and transformations to the different joints. I took the arm bones and leg bones and spine, et cetera, and scaled them and moved them around until the skeleton looked like it belonged inside Clown’s body. At this point, the Violator geometry was distorted beyond recognition; but at least the articulation fit within Clown’s shape. Once that was done, we employed Isculpt and Caricature to take the Clown geometry and make it

built and animated by ILM. The transformation of Clown into the physically dissimilar character was facilitated by the use of a Clown computer model that was mathematically identical to the Violator model. This allowed the artists to manipulate the Clown model into the Violator model, and vice versa, without the need for a complex morphing process. The transformation was achieved by scaling and positioning the Clown model to match the Violator model, and then applying the Violator model’s geometry to the Clown model. This process was repeated for each of the Clown’s body parts, ensuring a seamless transition between the two characters. The final result was a transformation that was both visually striking and technically impressive.

into a shape that was applied to the distorted Violator skeleton. So we distorted Violator down into a general Clown shape; then we applied Clown's actual shape on top of it."

Proportional changes in the transformation from Clown to Violator were animated in Softimage, while Caricature was utilized for the more subtle shape interpolations. The transformation was further developed with wipe maps painted by Rebecca Heskes. "These wipe maps determined the speed and direction of the transformation on the surface of the body," noted Hery. "We had complete control of not only the interpolation of the geometries, but of the surface textures as well."

Although the initial transformation started and ended with digital models, the subsequent transformation of Violator back into Clown ended on a live-action image of John Leguizamo in makeup. "We had to match up to the live-action Clown," stated Turner, "because he did a bit of action that we didn't want to have to animate ourselves with a CG model. It turned out to be quite a big challenge, because the animator not only had to do the transformation in reverse, he had to match the exact position of the real Clown. We ended up having to do some morphing to get it to match up exactly."



Spawn is guided in his fight against hell's forces by Cogliostro, who watches the stormy harbinger of the showdown in a shot assembled by Banned From the Ranch. A bluescreen element of actor Nicol Williamson and a city skyline plate were augmented with matte painted elements provided by Bruce Walters of XO Digital, while BFTR animated lightning and thousands of particle system layers to create the roiling night sky.

After Violator's appearance, he and *Spawn* engage in a battle that moves from a gothic church rooftop to an alleyway below. Interaction between the two characters was provided by a combination of CG *Spawn*, CG Violator, live-action *Spawn* and puppet Violator elements. "We needed the CG *Spawn* for the shots where he is getting kicked around or thrown by Violator," said Turner. "Since we didn't have to worry about putting a stunt-man on a rig or injuring the actor, it made for a much more dynamic fight sequence, with really hard-hitting action."

In one shot in the fight, the CG Violator was animated to appear to pick up the real Michael Jai White as *Spawn*. "Violator appears and charges across the roof, picks up *Spawn* and slams him against a buttress," stated Turner. "Michael Jai White was shot on a rig against bluescreen, and that element was composited into the scene, along with our digital Violator – but it severely limited what we could do. We had much more freedom in the shots where we were adding the CG *Spawn*, because we could do all the action the way it needed to be done, without being tied to the vagaries of a motion rig that may have a little wobble in it or may not move with enough force. When a bunch of guys are just trying to move a rig around, they're not necessarily thinking about whether or not the actor on the end of it actually looks like he is being carried by a monster."

The CG Violator returns near the end of the movie to engage *Spawn* and Cogliostro in a battle in hell. Believing the demon has been defeated, Cogliostro and *Spawn* emerge from the fireplace portal in Wanda's living room. Within moments, however, Violator breaks through from the other dimension, appearing to emerge from the living room wall in an effect reminiscent of the T-1000's rise from a checkered linoleum floor in *Terminator 2*. "Tim Harrington animated Violator to look as if he had to make an effort to get through the wall in the plate," Turner explained. "His head came through first, then his hands, which grabbed a bookcase to help him pull himself into the room. The hardest parts were the technical issues involved in making Violator blend into the wall. When he pushes through it, the wall stretches with him and forms a membrane over his face. It has the look of a membrane with a life of its own." Habib Zargarpour created a Dynamation simulation, building the wall and bookcase in CG, while Andy White wrote specialized shaders to blend the character into the wall.

After his head is severed by *Spawn*, Violator suffers a meltdown, an effect developed by Mitch Deodes. "Mitch came up with a system of particle metaballs that were Violator shaped, with Violator texture on them," related Turner. "As he melted, these pieces dropped away, turning into a green goo. They fell to the floor, darkened and ran together, blobbing up. It looked quite hideous." During the meltdown, Violator's head transforms into the head of Clown, an effect animated by Marc Chu. "Once that transformation is made, we cut to the live-action Clown, who continues to speak dialogue as he melts into the floor. In most of those shots, the Clown's head was a green-



A computer generated Spawn emerges from a fiery crash after engaging Clown in a highspeed chase. Data gathered by motion-capturing actor Michael Jai White's walk provided the basis for the animation, accomplished by ILM.

screen element. We composited that over the clean plate and added more green goo oozing out where the neck was.”

In addition to its 3-D animation effects, ILM provided establishing shots through some ingenious digital matte paintings by Yusei Uesugi. Since the church around which much of the movie’s action was to take place had been built only as a rooftop set, Uesugi was charged with piecing together an establishing shot of the structure. “In order to get really good, accurate lighting and camera movement on the church,” Uesugi said, “I had to actually model it in the computer, rather than just paint it. Except for the far background, everything in the shot was built in 3-D.” Uesugi also added smoke and lightning, as well as live-action elements of *Spawn* and Clown on the rooftop. “When I first started working on this shot, there were no plans to add any live-action. But since it was going to cut right to a scene with Clown and *Spawn* on the roof, I thought it needed those live-action elements for continuity. So I went out with my wife to a golf course in *San Francisco* – the only place I could find to get an ideal camera angle looking down – and I put on a *Spawn* rubber mask and rolled around on the grass as my wife shot it in Hi8. The grass was like a greenscreen. I composited this Hi8 element into the establishing shot, with no intention of using it as a final element; I just wanted to do something quick and dirty to pitch the idea that this shot needed live elements. But when I showed it to Mark Dippé, he loved it and thought that it was good enough to be used as a final element. Then he said, “What about Clown? We need to get Clown in there, too.” Using a slightly better video camera, Uesugi shot chief modeler Stewart Lew in the Clown costume, performing actions against blue-screen. “We filmed it in twenty minutes, right in front of the *Spawn* trailer here at ILM. It took only ten minutes to digitize it, twenty minutes to extract and thirty minutes to comp.”

That kind of ingenuity and resourcefulness, both at ILM and Banned From the Ranch, was providing the low-budget production with a lot of bang for its buck. Even so, Dippé, Goldman and Williams were looking at having to create the spectacular climax of their picture, an extended battle sequence between *Spawn* and Violator in the depths of hell, entirely in camera. Although the filmmakers dreamed of creating a surreal digital environment for both the end sequence and other glimpses of hell scattered throughout the show, the realities of their still-modest effects budget mandated nothing more unique or inspired than practical sets backed by translights, or miniatures composited with matte paintings.

But, just before going into production, they had a bold idea. “Mark and I realized that if we dropped seven days off our principal photography schedule, that would give us the money to pay for our digital hell sequence,” Goldman noted. “So we went from a seventy-day shooting schedule – which no one thought we could do anyway – to a sixty-three-day shooting schedule. New Line made us sign this thing saying that we would not go over sixty-three days. And not only did we have to sign it, the crew had to sign it! On top of that, we had to convince all of our department heads, like our production designer, to take money out of their budgets – money set aside for building hell – and give it to an effects company. Department heads don’t like doing stuff like that. It was taking time, money and employment away from them, and giving it to someone else. But, amazingly, they all agreed. And that is how we came up with the initial million dollars for our digital hell sequence.”

“I think everyone realized that a digital hell was going to be better for the movie,” observed Dippé. “And shooting the movie in seventy days was going to be so hard anyway, why not do it in sixty-

three? It was extremely difficult to shoot this movie in that amount of time; but we did it. Our sixty-third day was our last day, and there were no reshoots on this film.”

Having found a means to beg, borrow and steal the money to create their digital hell, Dippé and Goldman immediately assigned the sequence to Santa Barbara Studios, a company recently joined by animation director James Straus, a longtime colleague from ILM. Initially contracted to produce twenty-six shots, the studio ended up doing seventy shots of digital hell – an eerie environment that had the look of burning embers punctuated with lava, flares and a continuous heat ripple.

The concept for hell was initially developed in the SBS art department, where art director Peter Lloyd rendered numerous illustrations. Second on the project was senior technical director Mark Wendell, whose job it was to get the ball rolling on the CG assignment. “I had to take all of these great pictures that Peter had painted and figure out how we were going to animate and render them,” Wendell recalled. “From Peter’s artwork we had a sense of what this hell was supposed to look like. It had to be an extremely dynamic and chaotic environment; so just placing a few spinning rocks and boulders into the shots wasn’t going to be enough. We needed to have flares and impact rings and lava and geysers – all sorts of crazy stuff. In order to have that work from shot to shot, we had to package the effects so that the least technical of our animators could still take these flares and boulders and plug them in as needed.” While Dynamation provided the overall atmospheric effects, larger shards and boulders were modeled in Alias, then texture-mapped with maps painted by Lloyd using Alias Studio Paint.

In addition to flares, comets and other fiery bodies, some shots in hell featured ‘hell-*Spawn*’ – an army of characters that seem to fill the infinite space. To create the army, production had filmed live performers in *Spawn* suits, then provided SBS with those elements. Straus and crew determined that a more dynamic and expansive army was called for, however. “Unfortunately,” commented Straus, “the performers in the production elements were doing much the same thing in all the footage. But the scenes required that this be a really rowdy crowd, with a lot of variety and insanity going on. We wanted hunchback guys and barking guys and deformed guys, short ones, tall ones – a whole range. Since the elements we had just didn’t give us that variety, we had to create our own.” Crew members were put into *Spawn* suits and photographed doing a variety of actions in front of a bluescreen. “What we ended up with was this huge library of movements and actions. Those elements provided texture maps to be used with the particle system to place hundreds of thousands of hell-*Spawn* in the environment. We altered the images to get more variety, making some of them different sizes and deforming the shapes. Mark wanted the impression of infinite armies; and the only way to do that was procedurally, using Dynamation.”



Featured in the hell scenes, the devil Malebolgia was at first intended to be realized via bluescreen photography of a rod puppet constructed by KNB. Although filmed, the puppet was eventually replaced with a CG model, built and animated by Santa Barbara Studios.

SBS's hellish environment was not only inhabited by hell-*Spawn*, but also the devil Malebolgia. In an attempt to produce the character as cost-efficiently as possible, the filmmakers had commissioned a two-foot-tall rod puppet from KNB, then filmed it against bluescreen. But, especially against the dramatic backdrop of the new digital hell, the rod puppet footage looked too much like what it was. Once again, the budget for creating a Malebolgia computer model did not exist. And, once again, the filmmakers' peers came through for them anyway. "When we saw that the Malebolgia puppet did not fit with the rest of the movie," remarked Goldman, "I called James at SBS and asked if I could send him the rod puppet, just so he could take a look at it and see if there was anything we could do digitally to enhance the footage. Instead, he actually built a digital Malebolgia for us. John Grower, the company president, let him do it – even though we didn't have the money to pay them and he knew they were going to take a hit on it, financially. They had built this digital hell sequence and they cared about it; and they couldn't see having its impact lessened with rod puppet shots. So they did this for us, simply because they cared. And the result was that we wound up with a hell sequence that really worked."

Due to the eleventh-hour nature of the situation, Straus modeled Malebolgia quickly by modifying the digital werewolf SBS had built for its recent *American Werewolf in Paris* assignment. "I figured out how we could modify what we had built for the werewolf and create an entirely new creature," recalled Straus. "Modifying that model was a lot faster than it would have been to build a new model from scratch; even though I had to completely remodel the werewolf head." Remarkably, Straus had a roughed-out version of the digital Malebolgia within a week. "At that point, I had something to show that was promising. From there, it took a couple of more weeks before we had a full working head and body."

In addition to producing the digital hell backgrounds, the hell-*Spawn* and Malebolgia, SBS



Spawn confronts Malebolgia in hell. Given the digital Malebolgia assignment just weeks before the film's opening, James Straus at SBS hastily modified an existing werewolf model to create the devilish CG character.



Malebolgia reprimands Clown in an earlier scene.



In the final showdown in hell, Spawn stems the advance of the hell-Spawn army by launching fiery bolts of necroplasmic energy. SBS photographed crew members –

was responsible for choreographing all the hell sequences, compositing bluescreen elements of the actors for some shots, and laying in ILM's *Spawn* and *Violator* 3-D animation for others – the first time ILM has allowed another company to composite elements produced within its facility. Animatics produced beforehand helped the Santa Barbara team to create dynamic finals. “We built this whole story of the hell fight at the end of the movie, and the hell baptism at the beginning,” Straus said. “Once we defined what was going to happen from scene to scene, we created, in rough form, every scene with cutouts and little hand animations that we did on our Flint stations. Mark Dippé could look at those animations and make changes or fix problems that were suddenly apparent. We had one great session with him on a Saturday – he came up here and we hashed out the battle sequence together. We got the whole thing worked out to what we called the bible cut, which we could refer to for the remainder of the show. That animatic defined – for both production and us – what was going to actually appear in the movie.”

In its final form, the climactic hell sequence has the characters flying and falling through a surreal, seemingly vast space. “It turned out to be a very good illusion,” Straus said, “mainly because Mark Dippé is one of the great computer graphics people. He knows what we can do; he knows how we do it; and he pushed it in all the right ways. But he never pushed us too far, because he understands the limits of what can be done in a specific amount of time. He knew exactly how many flares or fiery explosions he could ask for in a scene, given the time frame. That was very helpful.”

Spawn, in its original completed form – which featured less than two hundred effects shots – was first previewed on May 28. It would prove to be a watershed event. Response from both the test audience and New Line executives was so enthusiastic that the latter loosened their purse strings and soon approved an additional two hundred shots. “It became a whole new deal at that point,” said Steve Williams. “New Line really got behind us because they realized that we had a good movie here. We had a whole list of shots that we wanted to add; and at that point, we had the backing and the money to do it. It was probably intentional on New Line’s part. They were thinking, ‘If these kids have what it takes, they’ll take a little bit of money and turn it into something that looks like a \$100

dressed in Spawn suits and performing a variety of actions – then digitally replicated the imagery to create an army of seemingly infinite numbers.



The finale takes place in the home of Simmons’ former wife, where a fireplace serves as a portal to and from hell. Live-action plates featured a practical fire burning within the fireplace, rigged with nozzles to create a sudden surge of flame. Using both digitally manipulated fire elements and synthetic CG flames, Banned From the Ranch completed the effect of the flames reaching out of the enclosure and into the room, carrying characters within its fiery tendrils.



million movie.' And we did. From then on, they were totally behind us."

Violator and Spawn engage in a final confrontation in a computer animated sequence, realized by ILM. To make the Violator model as simple and manageable as possible, physical components such as the rib cage were suggested with displacement maps rather than 3-D modeling.

"Money began to flow for anything that we could dream up," remarked Mark Dippé. "Some of it went to extend the hell sequence from one minute to three minutes; but it enabled us to do a lot of other things, as well. It meant we could go back and put things in that we had designed initially, but had dropped when the realities of production set in. We were able to spend more money at ILM and add more cape shots. We were able to add shots of *Spawn* and *Violator* fighting. We were able to add all of the unusual, stylized transitions between scenes that I had wanted to do. There was a five-page list of effects shots we wanted for the movie, but couldn't afford. And then, suddenly, after this preview, we could afford them."

With the movie scheduled to be released in only two months, there was not enough time to burden Banned From the Ranch, ILM or Santa Barbara Studios with all of the new shots. New facilities had to be brought on; and the trio relied on its many longstanding relationships within the visual effects community to complete the suddenly expanded effects slate. "We didn't even have time to go through the usual bidding process or anything like that," recalled Clint Goldman. "We were just calling everyone we knew, saying: 'Go! Go! Go!' It was insane."

Eighteen additional companies – stationed everywhere from down the street from the *Spawn* production office to Tokyo to London to Hong Kong to Vancouver to Toronto – jumped into the last-minute frenzy. "Jimi Simmons at Western Images did sixty-two shots, working at an Inferno," said Goldman, "including some scene transitions and compositing. I'd worked with Jimi before, and I knew he could pull it off." Western Images also did a digital face replacement, replacing a stuntman's face with that of Michael Jai White for the scene in which Al Simmons is killed in the chemical plant explosion. "Another superstar, Jamie Dixon at Hammerhead, did forty-two glowing eye shots for us. And when we were having trouble getting a PG-13 rating because of the scene where Wanda is killed, Jamie did thirteen shots over a weekend to revise the scene.

"Imaginary Forces did our prologue, our main titles, our end crawl and end graphic – and that was a lot of effects. The prologue is a solid forty-five seconds of effects; and the main title is three minutes and fifteen seconds of effects! D-Rez had four Dominos going around the clock to put that together. EFILM did our film-outs. Eyedentify, in Tokyo, created a flocking program for the hell-*Spawn* army. C.O.R.E. Digital, in Toronto, did some motorcycle enhancement shots."

Another firm brought on at this late date was IDIG – Interactive Digital Intelligence Group – whose founder, David Biedny, had previously worked with Dippé, Goldman and Williams at ILM. With barely six weeks remaining until release, IDIG was given thirty-five digital effects shots. "For *Spawn*, we averaged a shot a day," remarked Biedny, "and we did that right up until the very end. We did all but one of the green energy glows on Cogliostro, and all of the shots of his blade glowing as it comes down from his arm. We also did glowing eye enhancements on all of the *Violator* animatronic footage." IDIG also had the dubious honor of creating cinema's first digital fart, which emanates from the decidedly uncouth Clown. "It was our proudest moment. When Mark Dippé saw it, he said: 'David, this is so repulsive I can smell it. You guys did an outstanding job.'"

Visual effects producer Tom Peitzman was responsible for organizing the effects activity that surged as twenty-one companies began delivering finals on a daily basis. The Internet was instrumental in containing the chaos. “I’d worked on shows where we had dedicated lines,” commented Dippé, “but those are very expensive, and they don’t go that many places. So we began using high-speed Internet lines, which allowed us to communicate with the people in Japan, Toronto, all over. They could Internet a file to us from Tokyo, for example, that would take twenty minutes for them to load and two minutes for us to download. So we’d have a file all the way from Japan in twenty-five minutes; whereas sending a tape through customs would take two days. It also allowed us to have dailies with Santa Barbara Studios three times a day. Within an hour, we could look over something, respond to it, make changes; then SBS would incorporate those changes and we could see it again. It was an amazing process that allowed us to get stuff virtually instantaneously. And since we were working with people in every time zone, there was always stuff coming in, no matter what time of the day or night it was. Those last few weeks, we never slept.”

The push for more and better shots continued, literally, up until the last minute of the final effects delivery date: Thursday, July 17. “We got a call from Mark on that Thursday,” recalled James Straus. “He had one last request – he wanted the green energy that comes out of the atmosphere and imbues *Spawn* with his supernatural powers to get sucked into his chest very clearly. We had less than a day to do this, and we had to do it right the first time. So we rerendered our atmospheric effect and composited it in. Then we had it couriered down to L.A., where it arrived just in time to be filmed out. It was incredible. We didn’t have a single minute to spare.”

Other urgent calls were also going out that Thursday. “Mark called us Thursday afternoon,” David Biedny commented, “because a shot that they had previously decided not to do somehow got left in the edit. It was a transition from a shot of Clown licking Wanda’s face that went into a full Cogliostro blade shot. All they had in their Avid edit was a white frame which was supposed to be a flash cut to Cogliostro and his blade. They had to have some kind of transition, and they needed it urgently for the final cut of the movie. And we only had about three hours to do it. We came up with the idea of creating the white flash cut with a pair of lens flares at full brightness at the beginning of the shot, then reducing the brightness until it ended up in Cogliostro’s eyes – which was an effective way to bring Cogliostro into the scene. It was only a second long, so we rendered it in an hour and sent it down.”

Given their roguish histories, *Spawn* represented something of a vindication for Mark Dippé, Clint Goldman and Steve Williams, for the movie was literally willed into being by the same renegade spirit that had more than once led to corporate reprimands. That vindication was even more heartfelt when the film enjoyed a twenty-plus million dollar opening weekend, and was greeted with generally positive reviews.

“*Spawn* was like jumping into a fire for all of us,” Dippé concluded. “It was a mixture of elation and horror. There were days when I thought, ‘What am I doing here?’ A movie is like a living creature. I thought of it as a bucking bronco – and we were on the back of it, yelling ‘Yippee-i-ay.’ We just had to ride the thing. We had to hold on, see the movie in our heads, and believe we could get it to the screen somehow.”

With a little help from their friends, they did just that.

Spawn photographs copyright © 1997 by New Line Cinema. All rights reserved. Production still photography by Peter Iovino. Additional images courtesy of Industrial Light & Magic, Santa Barbara Studios, Banned From the Ranch and MB EFX Group. Special thanks to John Smith, Ellen Pasternack, Stephen Kenneally, Bruce Jones and Diane Holland.

CLOSE CONTACT

image

article by
Kevin H. Martin

In a summer filled with lightweight, over-the-top entertainment – from dinosaurs stomping through San Diego to inter-galactic hordes infiltrating earth – *Contact*, a Warner Brothers release about a radio astronomer's search for extraterrestrial intelligence, offers up fantasy fare of a different sort. More reminiscent of the awe-engendering alien communications in *Close Encounters of the Third Kind* than the invasion films of recent years, *Contact*, in fact, originated in that less cynical time, having spent the better part of two decades in development. Producer Lynda Obst solicited a film treatment on the subject from world-renowned astronomer Carl Sagan and his wife Ann Druyan in 1979, around the time of Sagan's success with the Emmy award-winning PBS television series *Cosmos*. When the project subsequently stalled in development, Sagan transformed the concept into a best-selling novel, published in 1985. Prospects for the movie, however, would remain in limbo until 1989, at which time Obst – who found the project back under her aegis – again sought the input of Sagan and Druyan as efforts were renewed to draft a workable screenplay.

In 1994, director George Miller would attempt to mount the production, armed with a new script by Michael Goldenberg – although final screen credit would be shared with early *Contact* scribe James V. Hart – and with Jodie Foster in the lead role of scientist Ellie Arroway. After further delays, however, Miller and the studio parted company, sending the project into yet another tailspin. Finally, in 1996, the gauntlet was taken up by director Robert Zemeckis – in his first outing since *Forrest Gump* – and the film was finally greenlighted.



Noted astronomer Carl Sagan's best-selling novel about communion with an extraterrestrial intelligence forms the basis of *Contact*, a Warner Brothers summer release directed by Robert Zemeckis. Portions of the production were shot at the Very Large Array – a cluster of enormous radio telescopes in the New Mexico desert – the site where Ellie Arroway (Jodie Foster) first intercepts an alien signal transmitted from a distant star.



Senior visual effects supervisor Ken Ralston converses with Zemeckis during the VLA location shoot. Though *Contact* marked the seventh collaboration between the two, it was the first since Ralston departed Industrial Light & Magic to become president of Sony Pictures Imageworks.

As he did in *Gump*, Zemeckis was determined to break with tradition in *Contact*, mounting a film that would challenge audience expectations – a risky undertaking in a summer packed with boxoffice contenders. “That was the scary part,” observed Sony Pictures Imageworks president and senior visual effects supervisor Ken Ralston, whose company Zemeckis would turn to for the production’s visual effects. “This is a thinking person’s movie, competing with a lot of mindless films that don’t have the credibility problems we do because they’re so far over the top to begin with. Even more difficult is *Contact*’s abstract nature. The filmmaker has deliberately chosen not to supply any easy answers for audiences.”

In the script – based on Sagan’s novel – gifted, but emotionally disconnected radio astronomer Ellie Arroway sets out in search of evidence that will prove the existence of extraterrestrial intelligence. Scorned by much of the scientific community, she gains private funding to continue her work at the VLA – Very Large Array – a field of twenty-seven huge radio telescopes located in the New Mexico desert, where one morning she taps into a nonrandom transmission originating from the distant star Vega. As the world wrestles with the implications of the discovery, the message is decoded and found to contain blueprints for a machine capable of interstellar travel. Ultimately, Ellie’s personal quest for contact with the message originators lands her in the transport’s passenger seat, propelling her on a voyage across the galaxies that takes her from scientific detachment to spiritual enlightenment.

Although Zemeckis would reassemble many members of his *Gump* creative crew in mounting *Contact*, the involvement of Sony Pictures Imageworks would come about as a direct result of Zemeckis’ longtime association with Ken Ralston during the multi-Oscar-winner’s tenure at Industrial Light & Magic. “Ken not only sees the work with the same kind of vision as Bob,” remarked senior visual effects producer Debbie Denise, “he also had a kind of sixth sense about how far along we should go on any given effects shot before we showed it to Bob.” The degree of SPI’s involvement would expand as the production gathered steam. “Initially we figured on 150 shots, along with some onset video playback effects. But the shot list eventually grew to 340 – not including the video, which by then had become two and a half hours of playback and burn-ins – without a change in release date. By January 1997, we knew we’d have to involve other vendors. Ultimately, we elected to go with companies we had worked both for and with in the past, companies we knew could be counted upon to get the job done.” Among the firms brought on board as major subcontractors were Weta – a visual effects company established in New Zealand for the Zemeckis-produced *The Frighteners* – Industrial Light & Magic, Composite Image Systems and Warner Digital Studios. In addition, a number of miniatures were slated for construction by SPI’s in-house model shop, Thunderstone, headed by Phil Notaro. Big Sky Post, Pacific Ocean Post and Foundation Imaging also contributed to the burgeoning shot load.

Despite *Contact*’s otherworldly subject matter, most of its action would take place on earth, grounding the effects in a terrestrial reality. “About eighty percent of the effects are supposed to pass for everyday events,” Ralston commented, “with the essential aim being photorealism – even with objects and locales that were sometimes quite fanciful. Throughout the film, the viewpoint remains extremely objective – right up to Ellie’s ride in the machine, which is almost entirely subjective. Afterward, the perspective takes a radical shift back to the objective, as Ellie tries to figure out what really happened.”

“We had to be careful to avoid letting anything interfere with the buildup to the ride itself,” visual effects supervisor Stephen Rosenbaum explained. “We knew that if the audience had trouble buying the real-world stuff – and there were some brutally tough photorealistic shots, running forty seconds or a minute on screen – we would lose them for sure when they entered this incredibly subjective environment.” The remaining twenty percent of the effects – primarily consisting of Ellie’s ride and a phantasmagorical beach scene that follows – would not pass for cinema vérité. “Conceptually and intellectually,” Ralston observed, “the climax took this story down many of the same roads traveled in 2001. While we strove mightily to avoid treading on sacred ground, it was, to some degree, unavoidable – we were posing some of the same questions and trying to deal with big issues cinematically. We all looked at 2001 again, then asked ourselves, ‘What can we do that Stanley Kubrick didn’t already try?’”

Production designer Ed Verreaux, who had been shooting second unit for George Miller while the project was still under his direction, would see a whole new vision come about with Zemeckis’ involvement. While certain elements remained unchanged, a new look for the machine – the enormous space-warping device built to alien specifications – would result from early meetings between Verreaux, Zemeckis, producer Steve Starkey, and Zemeckis’ often-used production designer Rick Carter. “We talked about the structure of the universe – a story point which really only surfaces at the end of Carl’s novel – and from there seized on the notion of a spherical machine,” said Verreaux. “It would be a skeletal sphere, evocative of molecules with electrons describing the shape of their orbits. Atomic structures have often served as symbols, especially for corporations – even the old NASA logo reflects this. We extrapolated rings from these orbits and, over the next couple of weeks, nailed down the look of it.”

To continue the development of the machine from this basic concept, Zemeckis and Verreaux enlisted Stephen Burg, a conceptual artist with a solid background in visualizing the fantastic. “Ed’s earliest sketches of the machine already reflected the central idea of rings defining a spherical volume within which a wormhole would be generated,” recalled Burg. “This retained the essence of the machine from the novel, but its openness allowed for far greater depth and dramatic angles. In devising the towers and gantries that support the rings, the trick lay in finding the right visual balance. The infrastructure needed to be solid enough to withstand the machine’s motion – which, at the scale envisioned, would produce cataclysmic stresses on the supports – yet slender enough to allow for a clear view of the sphere defined by the sweep of the rings. Scale cues were essential, since we tend to relate circular structures to those in our experience and assume that because it’s a ring, it must be small. Although something of this scale, moving at such a high speed, is fairly preposterous in terms of current human capabilities, the machine was designed with the intent of achieving total reality on screen. Even the rings – primarily a visual icon – were broken up into numerous segments patterned after the magnetic coils found in a fusion reactor or linear accelerator. They were also layered or ‘sleeved’ to enable them to counter-rotate within themselves as well as revolve around the center. That suggested a complex mechanism within, as well as allowing for as many permutations of motion as possible.”

Aware that movement was central to the machine’s concept, Ed Verreaux enlisted the services of Tim Wilcox, a digital artist experienced in the use of Lightwave for generating elaborate 3-D visual effects. Wilcox would create early animatics, using a stand-in model to represent the still evolving

machine. “There were so many questions to resolve,” Wilcox recalled. “How big should it be? How many rings? Yet, as we came up with answers, they made the machine even more problematic. If the crane on the gantry was 1200 feet in the air, the four rings would be 880 feet in diameter. Then the question became: ‘How do they move – especially at such insane velocities?’” Wilcox’s early previsualizations would identify motion problems that remained essentially unsolved until SPI started animating their computer generated version. “At certain angles, depending on the speed of ring rotation, we found a phasing problem in the image – sort of a complex, changing-with-perspective manifestation of the image distortion sometimes seen in old westerns, when wagon wheels appeared to run in reverse.”

The method for introducing the pod – designed to carry a human – into the machine’s influence was a concept that, like the look and motion of the machine itself, would evolve over time. “Originally, we thought it would be on a ramp extending directly into the center of the machine effect,” Verreaux stated. “But how would you get rid of the ramp when the rings start spinning, while still keeping the pod suspended? There were certain science fiction solutions considered, but ultimately all of them would force us to let the machinery dictate the story – which wouldn’t have been good storytelling. Then Bob came up with the idea of dropping the pod into the machine. It was kind of magical as well as death-defying – having the pod pass safely through these giant speeding rings was like dropping a bird’s egg through a beater without getting an omelet. That’s when we came up with the gantry arm, which created more design work but improved the look dramatically. Not only did we have the world’s biggest gyroscopic spheroid, but above it was the world’s biggest cantilevered arm.”

With two machines featured in the script – one built by the U.S. government, the other by Japanese industrialists – there was the matter of how to distinguish between them. “We reasoned that different countries would build the same structure in their own unique fashion,” related Wilcox, “using whatever methods were most typically employed there. The difference in looks would ultimately be predicated on available materials. So while the geometry remained the same, the textures of the two machines differed enormously.” One major



The film opens with a three-and-a-half-minute visual effects shot – a powers-of-ten pullback that provides a glimpse of never-before-seen galaxies. From an initial closeup of earth, the view widens and recedes to include the solar system, the Milky Way and, finally, the nether reaches of the universe. As the pullback concludes, pinpricks of light from the receding galaxies are revealed as reflections in the eye of young Ellie Arroway. SPI orchestrated the complex, computer generated sequence as one long, uninterrupted effects shot, with appropriate perspective changes as the camera moves dimensionally through space. Astronomical research lent a high degree of authenticity to the interstellar depictions.



The film opens with a three-and-a-half-minute visual effects shot – a powers-of-ten pullback that provides a glimpse of never-before-seen galaxies. From an initial closeup of earth, the view widens and recedes to include the solar system, the Milky Way and, finally, the nether reaches of the universe. As the pullback concludes,

structural element did differentiate the two. The NASA machine was engineered on the ground, but the Hokkaido device would be built atop an oil rig, prompting Burg to excavate old reference materials from his months on *The Abyss* in order to develop a look for the installation.

Although a decision as to whether the machine would be realized as a practical miniature or in the digital realm had not yet been made, the production needed video playback material of the machine for the impending main unit shoot. The voluminous reference textures and structural data already garnered would help enormously as Burg drew up large blueprints. “The plans featured every key detail,” Verreaux stated, “with a map explaining what you would find in any given area of a structure. After a visit to NASA, I was committed to keeping a consistency to the look. Later, when it didn’t go as a miniature, Sony okayed us to supply them with specific geometries, which Tim Wilcox created just using Lightwave. That allowed Sony to concentrate on texture maps to enhance the model geometry.”

While concepts for the machines progressed, Ed Verreaux – aided by art directors Lawrence Hubbs and Bruce Crone – also began devising the look of the various machine control rooms, based on real-life counterparts at Cape Canaveral. One difference would be the function of the windows. “The windows in the blockhouse at Canaveral aren’t really designed to allow you to view the pad,” remarked SPI senior art director Marty Kline. “They’re angled back so you can see the bird in flight. In our case, however, nothing was supposed to be flying.” Jerry Griffin, who had served as a technical advisor on *Apollo 13*, was engaged to inspect both the Florida and Hokkaido control room sets prior to shooting, ensuring that proper workstations were featured and arranged in NASA-correct positions.

Contact opens with a dazzling, powers-of-ten pullback that begins on a closeup view of the earth as seen from space and expands, at ever-increasing speed, to encompass the visible universe, and then some. As the pullback continues – without a cut – galaxies dissolve into mere pinpricks of light, which turn out to be reflections within the eye of young Ellie Arroway. The intent of the shot was not so much to dazzle as to convey the awe and immensity of space. “We knew, right off, not even to try that typical, weird space stuff,” remarked Rosenbaum. “We didn’t want texture maps plastered on geometries with interesting displacement and lighting to get things popping out. We were going full-out to get volumetric renderings with real substance at extremely high resolution.” CG sequence supervisor Jay Redd found inspiration in a SIGGRAPH presentation, entitled *Galaxies Collide*, depicting the tremendous vistas of space. “Our aim,” related Redd, “was to improve on that while reminding audiences about the true scale of things. And we wanted to do it as one big CG shot – the most realistic ever produced. Instead of having a single, remarkable object highlighted in the frame – which seems to be the norm with the way the technology has been exploited for monsters and such – we had to generate the entire frame.”

pinpricks of light from the receding galaxies are revealed as reflections in the eye of young Ellie Arroway. SPI orchestrated the complex, computer generated sequence as one long, uninterrupted effects shot, with appropriate perspective changes as the camera moves dimensionally through space. Astronomical research lent a high degree of authenticity to the interstellar depictions.

Intended to run about ninety seconds, the pullback took on greater dimensions as Redd developed the various elements. “I did an animatic that ran about 4400 frames – going that slowly was the only way to get anything approaching credible scale. Initial response from production was that it went on too long. They were afraid people might walk out on the first shot in the film if it pulled back at a crawl. But their thinking changed. The slower the tracking, the more the elements appeared in scale and the greater their apparent size became.” The finished shot, excluding a live-action element at the end, would run a whopping 4710 frames – nearly three and a half minutes of computer animation.

To nail down the visual concepts, a variety of optical and in-camera approaches were employed. “Phil Notaro used a cloud tank to generate a general look for space elements,” explained Redd, “but the timings and subtle color variations kept being changed, so eventually we had to abandon that approach. We ended up using Side Effects’ Houdini for choreographing the pullout, which allowed us to do a number of iterations quickly. Houdini gave us a quick front end to RenderMan, so we didn’t have to dump out an object and then paste shaders onto it. Instead, shaders could be assigned within Houdini, allowing us to render a frame and check it. Another consideration was that some people didn’t know how to use all of RenderMan’s capabilities. Houdini gave these people access while others on the team, like Clint Hanson, wrote shaders for them. Now we have a huge library of shaders available for use.”

An equally large library of scientific reference material was also assembled. Astronomical visual consultant Don Davis, a *Cosmos* alumni, had created colorful, yet realistic, visions for NASA that virtually defined the look of future space habitats. Jon Lomberg, another deep-space artist and principal concept artist for Carl Sagan, also worked with the SPI team. “Jon was very useful in helping us visually comprehend what one might see on an interstellar journey through the universe,” stated Rosenbaum. “For example, he had drawn some flat art of the Oort cloud, the theoretical cloud of comets that surrounds our solar system. Marty Kline used that drawing and came up with idea that if we passed through the icy comets in 3-D space, we might see a rainbow or ‘sun-dog’ effect from the sun glints.” As the sequence grew, so did the number of people working on it, painting texture maps and developing procedurals. “We had just about every issue of *Astronomy* and *Sky & Telescope* magazines on hand as reference,” related Redd, “along with shots from the Hubble telescope. Scientific accuracy was the goal – accuracy, and of course pretty colors.”



At the Arecibo radio telescope in Puerto Rico – the largest in the world – Ellie surveys the massive antenna dish in a shot that follows her out to the installation upon her arrival at the project site. A background plate, filmed at the actual Arecibo facility, required digital intervention by Composite Image Systems when the real antenna dish was found to be in a state of disrepair, with skies above darkened by inclement weather.



The final shot reveals a color-corrected sky and a refurbished dish, achieved via digital matte painting and tracked into the moving shot. To complete the shot, digital artists had to isolate both Jodie Foster and the foreground

greenery from the plate photography and then reinsert them over the cleaned-up dish.

For opening frames of the backlit earth, the digital team developed grids based on satellite photos of the earth's surface so that movement could be seen

beneath the cloud layer. "The surface was made up of extremely detailed texture maps at 4K to 6K rez in order for it to hold up," Redd remarked. "Also, when you look up at the night sky through atmosphere, the stars are twinkling. Since we're looking down through that same atmosphere, the lights on the surface scintillate in a like manner." Mike Perry developed the lighting scheme for the earth, while the moon's cratered, pockmarked surface – seen fleetingly – was created via displacement. "Behind earth – as a backdrop to the pullback through our solar system – the outer arm of our galaxy is faintly visible, as is our sun. There's a flare element for the sun, first achieved with stage elements. Retouched, those elements gave us blooming-out flare. Combining different elements from genuine flares and enhancing them with animation and parallax seemed to produce the best results – a stack rotating in 3-D space around the center of the lens."

Heightening the pullback are details of the solar system – the face on Mars, volcanic activity and ice patterns on the Jovian moons Io and Europa, storm activity within the great red spot on Jupiter – all reality-based as verified by telescope and space probe observation. "As we reach the outskirts of the system," Redd commented, "we take a bit more license, introducing elements as yet undocumented photographically, such as a system of comets called the Oort cloud. That was visualized as backlit, illuminated particles – like a sprinkler in sunlight – created via particle animation."

As the pullback continues, sights familiar to Hubble buffs now come into view, beginning with the Eagle nebula. "The real astronomical shots are from a single fixed position," remarked Redd, "but in our shot, we travel through the phenomena dimensionally, with perspective changes developed mathematically. We spent an enormous amount of time coming up with ways to create these images procedurally without resorting to texture maps, which would have to have been huge to create the necessary sense of volume. If we were going to texture-map a sphere, it would have been necessary to soften the edges and do all sorts of tricks to get it to look decent. Instead, we used RenderMan to get all of this procedural gas and noise, since it has such great controls for opacity and fall-off. Rick Stringfellow and Clint Hanson created the luminous backlit effect."

The pullback accelerates again as the view widens, first to encompass the Milky Way galaxy – passing greater and lesser Magellanic clouds, repositioned somewhat for effect – then revealing the thirty or so galaxies known as the Local Group. Astronomical photographs obtained from an Australian observatory were texture-mapped onto cards to imply a sense of perspective. Balancing speed with the immensity of these objects became more of a problem at this point. "With the limitations of current software," Redd commented, "we simply ran out of space. The camera was hitting a wall at the end of the universe. We could not push it back; so, instead, we moved the objects in frame further away to get that sense of speeding up as the supercluster of galaxies zoom away. Theoretically the entire shot is done on a 50mm lens, but we bent the focal length in order to finish the pullback. It was a kind of cheat; but since the camera is supposed to be traveling faster than light, you could rationalize that any genuine image would be color-shifted out of the visible light spectrum and read as black. From our point of view, it was better to have a technical compromise than an artistic failure."

Although scientific accuracy was obviously a consideration, there were other points in the pullback where the digital artists found it necessary to take advantage of artistic license. “There is a wonderful sense of revelation with the cosmic pullback,” observed Marty Kline, “but adding subjectivity was a little too much. Just a bit of a weave in the camera move would distract your eye from the scene’s focus. But there were some points where we needed to cheat transitions – the clouds within the Eagle nebula have varying levels of color saturation that you can’t just turn off and on. So we ramped up through them in order to avoid disrupting the image flow and distracting the eye from the pullback.”

After the myriad galaxies have receded to pinpoints of light, the entire pullback widens further to reveal the eye of young Ellie (Jena Malone). “We built a 3-D model of the girl’s eye and blended it into her real eye as the camera finishes pulling back to a medium closeup,” Kline related. “The model – an orthographic projection map built from 6K texture maps – even had eyelashes, modeled by Marty Havran in Alias, augmented by in-house tools. Then, with the blink of Ellie’s eye, we are out of the cosmic and over completely to the live-action element – which unfortunately was not the strong, sharp image we had hoped to get. We went through the live-action footage and found a good still frame further along in the pullback, then scanned it in at extremely high resolution, and Daryl Muntun used it for a 2-D pullback incorporating our CG eye model.”

While principally involved in the cosmic ride sequence late in the film, Weta would contribute a unique Zemeckis-inspired transition for the opening, as the camera sweeps up to Ellie’s house and inside to a close view of the girl conversing with her father. “Production had a plate moving in on the real house,” recalled Weta digital artist Gray Horsfield, “and another from stage which continued the move inside. Rather than morphing – which would have been seamless, but would not have given us the necessary level of reality – we built 3-D geometry which linked the two moves, while adding shadows and reflections as the camera moves through the window and into the house during this 2200-frame shot.”

Zemeckis’ insistence on getting lengthy shots in one continuous take led to the development of a new kind of effects transition, dubbed ‘blorph’ by the SPI team. “The derivation is from blending and morphing,” Debbie Denise revealed. “We used it for transitions which weren’t exactly cuts or dissolves. The first time you see one in the film is when we pull back from Ellie as a little girl and keep going – right out through her bedroom window. The camera travels in time as well as space, coming in through a



For a sequence in which a White House press conference is called to confirm the alien contact, digital artists at SPI incorporated actual video footage of President Bill Clinton – commenting upon fossilized lifeforms found in a Martian meteorite – into a cinematically fabricated environment. While the president’s comments were sufficiently topical to be used verbatim, manipulation of the archival video was required to extract him from the speech’s true outdoor setting and insert him into a White House press room set constructed for the film. Imagery on a foreground video monitor was burned in during postproduction.



For a later White House Cabinet briefing, digital artists substituted the head of a Clinton stand-in – seated at a table with national science advisor David Drumlin (Tom

control room window to reveal Ellie as an adult, now played by Jodie Foster. The exterior house was in Virginia, but they couldn't shoot inside; so that was done on stage here. It gives the same kind of feel as the wild, flying walls that Hitchcock used in *Rope* and *Under Capricorn*, and that Coppola used more recently in *One From the Heart*.”

Ellie's initial assignment takes her to Arecibo, Puerto Rico, where the world's largest radio telescope is located. Composite Image Systems was contracted to handle several lengthy shots for the sequence. “When Ellie first arrives,” explained CIS visual effects supervisor Ken Jones, “there's a thirty-second shot in which we follow her as she goes out to see the dish. We had to color-correct the sky to make it seem less cloudy. Then, since the actual location antenna dish was very dirty and had missing panels and fence sections, we replaced it entirely – creating a digital matte painting for it, rotoing it and then tracking it back in on top of itself. Since Jodie crosses in front of the antenna while the camera is moving, we created mattes for both her and the foreground greenery, then composited both back in over the cleaned-up dish.”

Other CIS work was included in a night scene at Arecibo, as Ellie and spiritual leader Palmer Joss (Matthew McConaughey) gaze up at the starlit sky. “The main collector and a large section of antenna are visible behind them,” Jones related, “and we added a starfield and a nice glow on the horizon as the camera tilts down. Back in the seventies, I had worked with Carl Sagan on the Viking Mars lander project, and CIS owner Joe Matza had later worked with Sagan on Magicam effects for *Cosmos*; so we both thought it would be a nice tribute to Carl and his dedication to science if we accurately portrayed the night sky with the stars in their actual positions relative to that latitude. I downloaded astronomical data from the Internet and created the whole field of view. When Ellie points at the Cassiopeia constellation, that is, in fact, what's up there.”

When her Arecibo research grant is terminated, Ellie strikes out on her own, eventually winding up at the VLA radio telescope facility in New Mexico. Sitting atop her convertible in the predawn desert, she hears over her headset what turns out to be a genuine signal emanating from the Vega star system. The task of developing a cinematically appropriate representation of the alien message fell to SPI. “Having worked with us before,” remarked Steve Rosenberg, “Bob Zemeckis had enough confidence to allow us to figure out the series of technical events that leads us through the message sequence. We began by researching how one might attempt to communicate with extraterrestrial life. We read articles by astronomical authorities such as Frank Drake and studied Carl Sagan's design for the Pioneer 10 probe. Then Marty Kline, video graphics supervisor Ian Kelly and I paid a visit to Jill Tartar, director of the SETI Institute in Northern California. She outlined how a signal from space would be received, and what programs would be used to track it. We knew that this film would draw astronomers from around the world, so we wanted to be technically accurate. The sequence of receiving the initial signal, as well as the terminology and the programs displayed in the film, are characterizations of a real process.”

As Ellie and her team struggle to decode the alien message, they discover video images of Adolph Hitler, opening the 1936 Olympics in Berlin, embedded in the signal. “Once we started breaking down the signal to reveal other messages,” remarked Rosenbaum, “we had to take creative license. Still, to keep it feasible, I called in Jet Propulsion Lab scientist Tom Kuiper and his mathematician wife, Linda, as technical consultants; and, along with Marty and Ian, we began postulating on how

Skerritt) and national security advisor Michael Kitz (James Woods) – with that of the real president.

to unfold the data-heavy messages without putting the audience to sleep. Getting from the initial signal of prime numbers to the Hitler images was fairly straightforward, but figuring out how to hide reams of information within those images, describing how to construct the machine as well as decipher an alien language, was tricky. We came up with the idea of interlacing additional information within the various fields of the signal. We took each decoded field and pasted it with the alien-looking wording and graphics developed by concept artist George Suhayda. The primer contained within the message was the key to making the decryption more interesting to watch. With that in mind, we decided that if we connected pages of information to form one corner of a cube, then used the primer to guide us on connecting each new corner, an entire set of specific information would be revealed.”

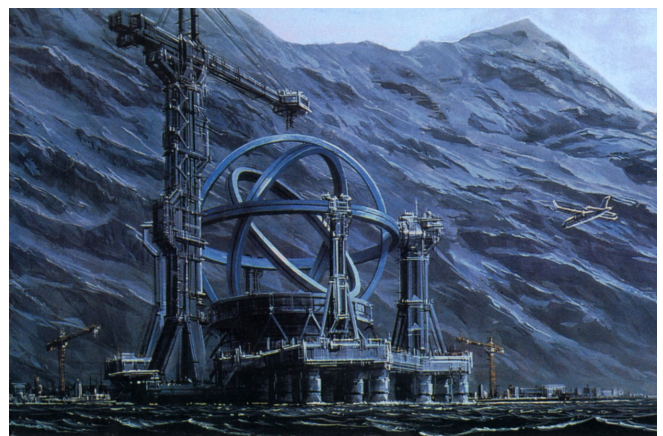
Generation of the message elements was overseen by highspeed compositing co-supervisor Mark Holmes. “We designed the animation for the decoding sequence to be played back on set,” Holmes explained. “The image rotates, changes from negative to positive, and pulls back away, eventually revealing a broadcast of Adolph Hitler opening the 1936 Berlin Olympics.” Archival footage selected for the sequence presented problems. “The microphone was right in front of Hitler’s face, so the production went to the expense of building a set and hiring a double. But that didn’t work because the actor was barrel-chested and came across as too strong physically.”

From Ken Ralston’s perspective, the whole idea was doomed to failure. “This was a defining moment in the picture – a big shock to the audience – and dramatically, you couldn’t justify doubling a historic figure because the audience would not buy it.” The problem was solved by reinstating the original footage digitally, cutting out the obstructing microphone and repositioning it beneath Hitler’s face.

Further alterations had to be made. “What we were showing was supposed to be a television signal that had been broadcast into space, intercepted, and sent back,” Holmes stated. “This meant that we had to make the image look more like transmitted video than film. Fixing the emulsion sag, eliminating film scratches, and correcting for uneven film development was essential to maintain credibility. We couldn’t access the original transmission



Production designer Ed Verreux consults with 3-D computer artist Tim Wilcox and conceptual artist Steve Burg on designs for one of the enormous transport devices constructed to specifications embedded in the alien radio transmission. The screenplay called for the building of two such machines – one at Cape Canaveral in the United States and the other off the island of Hokkaido in Japan.



A near-final concept for the Hokkaido machine drawn by Burg. Though different in detail, both machines were essentially enormous gyroscopic spheroids, with solid support structures and a cantilevered arm for introducing a pod carrying a human passenger. SPI would later contribute the design, modeling and motion of the rings,

because in 1936 it wasn't possible to record video – no kinescopes yet existed – so it was just broadcast right out into space. Only the Vegans have it now.”

realizing the machines principally via computer animation.

High-tech equipment was employed in an effort to give the film footage the look of ancient video; but state-of-the-art systems could not produce analog artifacts. Dubbing several generations to the worst-quality tape available, and forcing the digital gear to display its poorest possible output, ultimately garnered an image sufficiently crude to pass for 150-line-resolution video.

On-set playback of this and other imagery benefited from several innovations. “We didn’t want a fixed animation requiring the actors to hit certain cues,” stated Debbie Denise. “Instead, we set it up so that this big grainy video signal could be cued by the actors through playback off a hard drive. Ian Kelly was the stage video technician who came up with the setup. For each of twenty or so stop points built into the sequence, you’d see something that looked like a live signal with moving animated elements. Then an actor would operate the keyboard or say a line, and the next key image would unspool. The solution had its good and bad points – good for the actors, who were able to give more natural performances; bad for us, because after that, Bob Zemeckis wanted this kind of flexibility for all the on-set materials.”

For a sequence in which President Bill Clinton holds a news conference to discuss the breakthrough, actual footage of the president was employed. “The Clinton sequence is interesting primarily from a historical aspect,” Holmes observed. “We kidnapped the president digitally and used his own words in an entirely different context to support the scene.” The actual August 1996 speech, in which Clinton commented on the discovery of fossilized life found within a Martian meteorite, was used nearly in its entirety, though manipulated and enhanced to fit the scene. “This is unlike the archival integrations used in *Forrest Gump*,” noted Denise. “For Gump, the words spoken by the historic figures had to be altered, and it took ten people working six months to do less than a dozen shots. The amount of effort on these shots was insignificant by comparison.”

Even so, a substantial amount of digital manipulation was required to incorporate the presidential remarks. “There’s about a three-minute sequence of Clinton waxing poetic, with maybe seven edits,” Holmes said. “That sounds simple, but each angle was shot with different equipment and formats, none of which matched up quality-wise. Plus we needed to isolate and remove Clinton from the outdoor locale of his speech, and place him in the White House press room set featured in the scene. So we cut him out, modified his hair color and his flesh tone, added a whole new background and created another podium. Wind blowing did not become an issue for us, thankfully, because his hair was pretty well lacquered down.”

SPI digital artists expanded their repertoire of tricks to add other refinements to the press conference sequence. In a concluding shot, a TV monitor at the back of the press room shows Clinton leaving the podium, while the same action occurs ‘live’ behind the monitor. The monitor imagery was originally a Vistavision lockoff element with electronic pan-and-scan camera moves added – first to track a Clinton double as he passes behind presidential advisor Rachel Constantine (Angela Bassett), then follow Constantine back as she retakes the podium. “The double was okay,” said Holmes, “but this was a medium close-up on a monitor filling a good part of the screen. So we brought the real Clinton element in. Since he was turning nearly ninety degrees as he stepped down, the element had a genuine camera pan containing radial motion instead of the linear action

of our pan-and-scan move on the double and Angela. So we ended up using the real pan for the first part of the shot, syncing up the artificial move to coincide with the point when we switch directions to follow Angela. Also, there weren't enough frames of Clinton to get him as far over to one side as we wanted, so the last section is actually just a locked-off still frame of the president that we animated up, down, and to cross behind Angela. Retaining proper motion blur was really nasty."

The other trick involved pasting the doctored image into the screen area of an on-set monitor in the live-action footage. Only one of many such 'nested' composites – several of which are cutaways of various characters watching the president during the news conference – this image had to track precisely in order to maintain alignment with the monitors glimpsed by Zemeckis' ever-moving camera. Additionally, it required considerable finessing to create all the interactives needed to sell the monitor image as genuine. "A lot of these burn-ins are intended to read as video on film," Holmes admitted. "We had to make it look like a monitor, but with better quality – no horrendous hot spots, yet still including levels of interactivity and reflectivity on the bezel around the screens to give it verisimilitude. Some of the tracking shots required us to go a full 180 degrees around these monitors while maintaining proper perspective, and for ridiculously high frame counts. It was a long learning curve for us to create that level of reality, but we can do these video monitor burn-ins in our sleep now."

The final monitor composite for the conclusion of the press room scene was done at video's standard 30 frames per second, then translated to 24 frames per second and synced with the matching action of the live wide shot. "One benefit of our early work on this sequence," revealed visual effects producer Julia Rivas, "was being able to provide our formula to the other vendors to ensure a match in effects styles – especially with the video monitor burn-ins." In some instances involving the Clinton scenes, digital artists replaced people in the live news shoots with actors. Mimicking the live footage required intricate match-moves to replicate shooting errors, such as reproducing the 'bounce-back' concluding a rough camera zoom in which the telephoto view rebounds slightly after reaching maximum focal length.

In a later cabinet room sequence, President Clinton again appears, this time alongside David Drumlin (Tom Skerritt), Ellie Arroway's duplicitous boss, who later becomes her chief competitor in the selection of a representative to ride in the machine. "We filmed plates of Skerritt on set with an empty chair beside him," noted Holmes, "then added a stand-in's body, cut off the head and pasted Clinton's head on top. In one instance, we had to build the chair by pulling elements from other chairs in the scene. Background flags came from a separate video element. Other problems included flashbulbs – some firing in the Clinton head shot, others during the regular shoot, but none in sync. We had to add counter-flashes to each element to tie them all together."

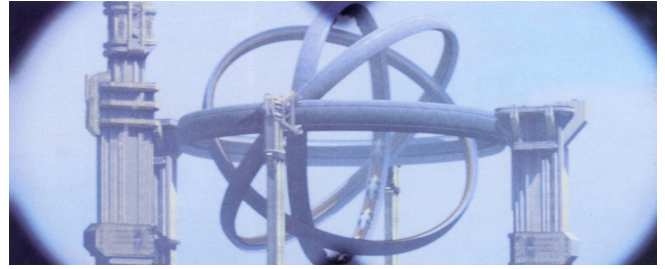
While the worlds' best encryption experts remain baffled by the alien hieroglyphics contained in the message, the code is finally broken by Machiavellian billionaire S.R. Hadden (John Hurt), who discovers a much sought-after primer – a guide to interpreting the transmission – concealed within the data. The decoded message gives clear plans for the construction of a machine – presumed to be some sort of transport – and after much debate, NASA commences work on the device at Cape Canaveral in Florida. An establishing shot of the finished machine was achieved with a digital matte painting, enhanced by sky replacement and a match-move to a background plate of a helicopter flyover revealing crowds gathered along the Cape. Also incorporated was a plate of Ellie in a

helicopter – shot static on the ground and requiring a variety of animated effects, such as rotor action.

Shots of the machine were primarily distant views, with big, dramatic closeups reserved for later, when a second machine is introduced in Japan. “The Canaveral shots were more in the nature of long-lens camera shots at a rocket launch,” Marty Kline commented, “about three miles away most of the time, except for some closeup detail views for on-set playback and burn-in – tight shots that gave the sequence an extra dose of reality. Brian Van’t Hul, who has lots of experience with stop-motion sets and lighting those kinds of setups, worked on the digital end this time out, doing these distant camera views – most of which were late-morning shots with typical Florida overcast. The metallic look of the NASA machine was developed based on the way surface oxide film causes rainbow reflections on metal. But those elements were a bit faint in daylight, causing it to look less iridescent than we had hoped. Although you wouldn’t think so, shiny metallic objects in CG are really difficult to do well – you can get it shiny, but making it look real, with all the subtle indentations and smears you see in real life, takes forever.”

Before the machine can be activated, sabotage by a religious fanatic causes it to be blown to pieces. For the destruction of the machine, overseen by sequence supervisor Ken Hahn, debris is seen hurtling right out of the haze toward camera. “That allowed the specular qualities of the metal to come through clearly, though briefly,” noted Hahn. “We had to create geometries permitting these pieces to be deformed through twists and bends during the blast. At first we thought that scientific visualization of a dynamic simulation would deliver the goods, but programming all of the tensile strengths would have taken days – and there was still no guarantee it would work visually. Bob wanted the hits to build in size to crescendos, like music cues. So while some procedurals were used, the precise choreography of the splashes, as debris hits the water, mandated plenty of painstaking hand work.”

The destruction of the machine, originally conceived as a scale miniature demolished by pyro, was a complex animation and rendering exercise. “The choreography of the destruction was dramatically paced,” said CG supervisor Jerome Chen. “The sequence didn’t lend itself to a dynamic simulation of something ripping itself apart – our early tests showed that a dynamic approach was impossible to tweak. Instead, we opted to hand-animate each piece of the machine destruction.” The SPI character animation group – headed by Eric Armstrong – was brought in to create the



Viewed from a distance through binoculars, the fully assembled NASA machine – computer generated by SPI – appears slightly obscured in the late-morning Cape Canaveral haze.



Spectators react as a saboteur’s bomb destroys the gargantuan structure during a test run, hurtling giant chunks of wreckage into the water. The dramatic destruction – choreographed and digitally assembled by SPI – featured hand-animated CG wreckage, practically photographed impact splashes and particle dust effects composited into live-action plates showing horrified onlookers.

dramatic destruction. “Eric provided the control Ken and Stephen wanted in terms of placing where each piece of wreckage flew in the shot. After animation signoff, the render team, led by Hahn, textured and lit the machine and also created particle dust effects elements, which were composited with the Florida plates of horrified crowds running from the explosion.

“There was nothing in the landscape to help cue the machine’s size,” observed Chen. “We had to keep adding atmospheric haze to give it distance in the static long shots. When it explodes, the pieces and debris are enormous. As they impacted with the water, we varied the sizes of the splashes to help set the scale.” The impact splashes were pulled from a library of practical stage elements shot specifically for the destruction sequence, hand-positioned and slip-synced by the NASA compositing team, led by Scott McKee.

Killed during the explosion is Drumlin, selected above Ellie to occupy the machine’s sole passenger seat. In the wake of the tragedy, Ellie is contacted by her eccentric benefactor, Hadden – now in permanent residence aboard the Russian space station, Mir – and given a second shot at the voyage, aboard another machine secretly constructed on an oil rig in Japan. “We contacted a part of *Cosmosphere* called Spaceworks – a Kansas company that produced the full-scale replicas for *Apollo 13* and does a lot of work for the Smithsonian – to recreate Hadden’s living quarters aboard the orbiting space station,” remarked Ed Verreaux. “It was basically just a box inside of a tin can, completely unlike the modular designs you see for future American stations. Mir has been up there a long time, so it’s a real mess, with cubbyholes everywhere and stuff strapped all over the walls with velcro. When I checked with Spaceworks, they were building it like it was another one of their museum pieces. We had to convince them to trash it.”

The Spaceworks recreation was placed inside a huge roller rig, allowing the set to be spun upside down. “We filmed John Hurt on the end of a pole with a body rig, which is conventional enough,” remarked Ed Verreaux, “but since he was already upside down, it helped camouflage the trick. The natural little sags and wrinkles that occur in a gravity environment go unseen, since all of those giveaways get inverted on screen.” Verreaux enlarged the actual size of Mir’s portholes to allow a better view outside for a later scene – ultimately cut from the movie – in which Hadden, having succumbed to cancer, is buried in space. “He was wrapped in a rubber suit that looked like a giant condom,” said Mark Holmes. “We did a push-in on the porthole as the body got ejected – and you saw this 3-D body bag element rotating as it floated away. From the dust on the porthole glass to the haze above earth – all of it was 3-D work.”

Ellie is soon winging her way aboard a Hadden jump-jet toward a rendezvous with a company command ship in stormy Hokkaido, northernmost of the four principal Japanese isles. One of the film’s more complex shots involved the jump-jet landing on the command ship, serving as the operations center for the Japanese machine. “Our initial plan was to replace the upper deck of a real tanker with a CG version of the command ship bridge,” explained Jerome Chen. “But the tanker plate was shot in daylight from a helicopter, and the nature of the perspective shift in the camera move made it difficult to lock in our digital upper deck to the real ship.” The decision was made to replace the entire ship with a CG one, though the erratic nature of the helicopter plate still left a challenging digital match-move. “Charlie Clavadetscher tackled the 3-D match-move in Softimage; and although I had assumed we would need additional 2-D tracking to lock the ship to the water, Charlie got the move dead on. He has years of real camera experience, and has a sixth sense about

3-D match-moving.” The tanker was painted out of the plate, leaving the wake line, and image-processing at the compositing stage converted the bright and sunny surroundings into storm conditions. The command ship and accompanying armada were modeled in Alias, then texture-mapped and rendered using RenderMan. From production art department designs, Thunderstone constructed a miniature of the jet as a one-off, reproducing the front section of a Lockheed JetStar and melding it to a Harrier VTOL engine assembly. Coated with vaseline to create the illusion of its flying through rain, the two-foot miniature was shot motion control. Layers of practical rain were photographed and added to the final composite, which took almost three months to complete.

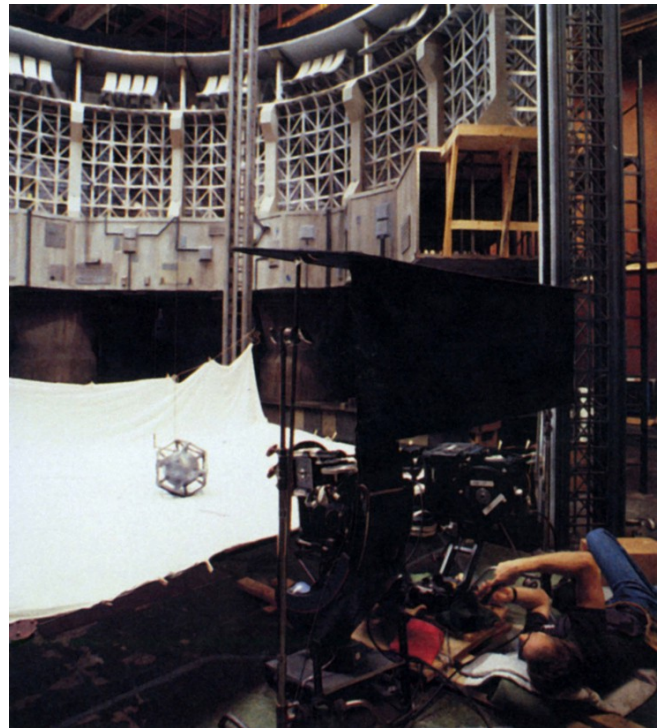
Ellie exits the Harrier and heads toward the command deck of the tanker. “In reality,” Debbie Denise elaborated, “there was no command ship. The only elements on stage besides Jodie were a couple of guys walking on a piece of grating and the front section of a plane. The entire environment had to be created after the fact – CG rain and practical rain, CG ocean water, and a practical element of the command bridge interior, shot on another set and inserted into the CG ship’s superstructure.”

Additional effects were generated to enhance the various levels of superstructure in the form of receding ceiling lights on each deck. Geometries and texture maps formed the interiors for other levels, seen fleetingly as Ellie approaches, while yet another Thunderstone miniature – fashioned from on-hand materials and standing eight feet tall – was built for a follow-up shot, later cut from the film, revealing the elevator wall behind Ellie as she approaches the command level.

An elaborate set was constructed to represent the command ship control room. Unlike its Canaveral counterpart – which had a translight curtain depicting the NASA machine in the Florida landscape – the Hokkaido control room was surrounded only by bluescreen. The sequence involved some forty shots of the control room interior – all requiring views of the Hokkaido machine and its mountainous backdrop, plus the three miles of ocean between the armada and the shore. Avid rough cuts from production editorial helped the SPI team devise a strategy for creating an environment that would be simple enough to execute consistently for the sequence. “We needed a



Following the destruction of the NASA machine, Ellie is whisked to the secret backup installation in Japan. An establishing shot reveals the offshore Hokkaido machine – fully computer generated – looming above stormy seas against a stark mountainous backdrop.



While both the NASA and Hokkaido machines were realized primarily as digital constructs, pod and gantry miniatures – provided by the SPI in-house model shop,

plug-and-play technique that would allow us to composite these shots quickly, yet look convincing,” said Jerome Chen. Upon assessing the multitude of camera angles in the sequence, SPI matte artist Ivo Horvat painted a large digital backdrop of the Hokkaido setting. “The painting was tiled together from helicopter plates filmed in Newfoundland by Ken Ralston. From shot to shot we cropped into the appropriate area of Ivo’s painting and matched the depth of field in the plate. If the windows behind the actors were blurred, we matched the focus in the composite.” SPI’s high-speed compositing group handled the tricky match-moves and bluescreen composites, adding ocean waves and clouds to Horvat’s painting to complete the illusion of the Hokkaido locale.

Thunderstone-were used for assorted views of the capsule
Revolving up to speed, the device’s rotating rings create a
launch
massive energy field that emits a brilliant and unearthly
glow – an effect digitally engineered at SPI. Monitoring the
trial is a computer generated command ship.

Suited up for her journey into uncharted territory, Ellie enters the realm of the machine. “We did some orthographic projections,” revealed David Jones, who supervised the Hokkaido machine sequences, “but only on areas we knew would be seen on camera. This was unlike the Florida machine, where we used a lot of 3-D paint because we didn’t know which side we would be seeing it from and it had to look great from all angles. The matte painters created flat textures, without lighting, that were mapped onto the geometries, then lit. Getting all the maps painted for these structures was a lot more time consuming than I expected. There were hundreds of textures and a mass of architectural models. Ultimately, a lot of the maps were replaced by geometries to make it look busy and angular.” Lighting for the machine was developed by Brian Van’t Hul. “It was a tricky job,” remarked Steve Rosenbaum, “because physically, this object is a big sucker that could realistically have taken thousands of lights. Brian did a great job of achieving scale; and between him and Jerome Chen, they devised a way to capture the grandiose nature of the structure without having to push the release date for the film to the year 2005.”

The large pod chamber built for the film had to serve for both the Florida and Hokkaido machines. “It was a set within a set,” Ed Verreaux commented. “The pod and everything holding it up remained the same, but the interior walls surrounding it were different, requiring a switch-out when we went from one machine to the other. The Florida version – seen only on video playback before it blows up – was an enclosed warm gray interior with pistachio green corrugated metals. At its center was the pod. There were a few spots where you could see below the ramp, so we put a shiny diamond-grate metal on the floor underneath. Then, as soon as we got an okay on the Florida video shoot, the construction crew tore the interior walls out, revealing the Hokkaido locale, which was cool blues and grays and silvers. It took less than six days to switch them out.”

While the NASA pod room appeared self-contained, the Hokkaido set needed to seem more threatening – so Verreaux left the ramp exposed to the natural environment. “On Hokkaido, you entered the set about twenty feet up. Beneath, there was just a blue-painted floor. We weren’t using bluescreen because of the Ritter fans and smoke effects. We ended up filling an entire stage at Culver City – right up to the perms, about thirty-eight feet in height.” Windblown and frightened, Ellie stares down from the gangplank, watching the roiling sea – digitally fashioned via Arete software – thousands of feet below. “The set was all metal, but to give it more of an alien, different feel, it was neither shiny nor dull – which made it more problematic in terms of how the CG background interacted with it.”

Visible beneath the access ramp are the enormous rings – which, as the machine starts, spin up to mach speed in just three seconds. “We had to be really specific as to what happens when those rings are spinning,” observed Rosenbaum, “so with the help of Marty Kline and Jerome Chen, I had some detailed key angles of the machine generated both as flat art and 3-D renders. Jerome produced a series of ring motion animatics; and through subtle physical cheats that nobody will ever see, we honed in on something visually interesting. From the initial startup to the final stage when the pod drops, we laid out a choreography of physical events that Bob Zemeckis used to cue his actors and the on-set light effects during the shooting of both the NASA and Hokkaido sequences.”

“It took a while to work out the movements of the rings,” David Jones elaborated, “because we needed animation that both looked good and made sense. Bob didn’t want the rings to line up, but since they passed through one another, we had offset angles. The outermost ring doesn’t move at all until the rocket boosters go off, just prior to the pod drop, while the innermost ring has blocks running counter – or at a tangent – to the actual ring movement. Stage had built some styrofoam rings pinioned together with masking tape to help us visualize the motion. We manipulated it all around till it fell to pieces. In the process of studying the model, those oddly-sliding blocks or shells suggested a means to achieve linkage and interaction between the various rings. The only way for it to slide while still functioning on multiple axes was if the inner part slid while the outer section pivoted. This inner piece of the outer ring was linked to the equatorial ring, which served to hold the whole machine together.”

The opposite, and presumably equal, forces of the machine’s spinning rings, could be likened to the simultaneous employment of both centrifugal and centripetal forces. “There were pivot points showing what really happens between the rings – the exact, particular interaction – but unfortunately we didn’t have any shots featuring them,” commented Jones. As they attempted to depict the rings in motion, the SPI team encountered difficulties. “Ken Hahn and Sho Igarashi worked out all this expression math to see how these things tied together, but some of the tracks created a disturbing washboard motion. It was very distracting to Bob, so we ended up cheating the animation to actually unhook a ring. It was impossible to physically achieve the configuration settled upon – so it was a good thing the machine wasn’t built as a miniature. Since it’s supposed to be an alien design, perhaps it achieves the impossible – at least so far as we understand physics.”

As the machine reaches full activation, the blindingly fast ring movements create strange eddies and eerie atmospheric phenomena both around and within the structure. “The shock-waves or contrails change shape with the ring movement,” explained Jones, “and these huge rings are moving in an arc – totally unlike a jet aircraft, though they’re supposedly going transonic as well.” Turbulent dynamics were modeled; however, attempting to understand the gusts – let alone depict them – was a nightmare. “Initially we came up with some really great wormhole effects, but we toned them down because the overall effect seemed too powerful for anyone to dismiss. It gave the impression that the machine had definitely done something, when in fact our story has to convey the notion – or at least the possibility – that nothing has happened at all. So all we would permit ourselves was a suggestion of strange condensation in the air. We couldn’t go wild and make it any more striking.” The final glow effect – developed by Laurence Treweek – incorporated digital elements with cloud tank elements shot by Jex FX to create the glow’s nuclear, but complex look.

Strapped into the pod, Ellie prepares for its release into the machine. “Our first thought for the pod was that it would be advanced, but entirely of human design,” related Steve Burg, “along the lines of the space pod in 2001. But Bob ultimately decided that the pod should be an integral part of the alien message, and closely related to the functioning of the rings; so it’s design was rethought to appear somewhat unearthly.” In the Sagan novel, the pod was a dodecahedron – an unadorned twelve-sided solid – a design the scientist had been adamant about retaining for the film. Zemeckis, on the other hand, preferred a spherical pod, both for its iconic value and the idea that it evoked thoughts of a diving bell – implying that it could withstand intense pressure.

Working closely with Ed Verreaux, Burg sought another concept for the pod which might somehow reconcile these diverse viewpoints. “The pod was to be built as part of an elaborate set, which included mechanisms for supporting it and deploying it into the heart of the machine. One thing that always helps when designing things for film is to introduce elements that break up the space, but do not obscure the camera’s view – lending a quality of visual depth to the environment. This line of thinking led us to come up with a titanium exoskeletal bumper on the outside of the pod. We realized that such a structure could echo the form of a dodecahedron, with its twelve pentagonal faces. This satisfied everyone’s desire to stay with Sagan’s original concept, while retaining the spherical pod Bob preferred.” Art director Bruce Crone oversaw construction of the set, while set designers Josh Lusby and Dean Wolcott did the final working plans of the pod and its attendant hardware and environs – a major feat made doubly difficult by the complex geometry.

Inspiration for the interior came from an unlikely source. “The containment core of the Tokamak fusion reactor is ringed on the inside by hundreds of electromagnets,” Burg explained, “which had a great ‘millipede’ look that influenced our design of both the pod and the rings. We used it to suggest the idea that somehow the pod has an inner structure which works in concert with the rings in some extraordinary fashion, allowing it to safely enter the wormhole through which Ellie travels into deep space.” The seat that Ellie is strapped into at the beginning of her voyage – and which eventually tears apart, having never been part of the intended alien designs – was built by Allen Hall’s crew from scale concept drawings by Burg.



SPI computer graphics supervisors Ron Brinkmann and Jerome Chen examine a computer generated shot depicting the powered-up machine’s nuclear glow.

Filmed at the end of the live-action shoot, interior pod shots made use of a special flip rig, built to create an unusual effect on Jodie Foster's features. "The camera kept the same orientation as Jodie and the pod interior," said Verreaux, "but now she was acting upside down, and her face changed appearance as all the blood rushed to her head. We used that as the pod drops, giving a real physical sense to this enormous plunge."

Wide shots of the pod drop were achieved with a sixteenth-scale pod model, built by the Thunderstone shop, articulated via a model mover and set up beneath a matching-scale crane bolted to the stage ceiling. "Fully assembled, the crane stood a whopping thirty-two feet tall," recalled Phil Notaro. "For closer views we went to a detailed quarter-scale hero pod and matching crane arm. The miniature had to match the full-size gantry set used when Ellie approaches and enters the pod. All of the interactive lighting was shot in miniature and duplicated on stage full-size. Even the digital pod used the interactive light from our miniature for timing purposes. Having the quarter-scale hero pod was necessary in order to get all of those glints and reflections. The pod is rotating a little as it falls, so there were changing shadows all the way down. It was subtle, though – the pod was not tumbling out of control, only being buffeted slightly by air currents." Effects director of photography Dave Stump and effects stage producer John Radulovic supervised the lighting and shooting of the miniatures.

Seen from Ellie's view, the pod travels through three tunnellike vortexes – theoretical constructs known as Einstein-Rosen bridges or, more popularly, wormholes – and is transported to a series of increasingly distant and beautiful locales within the Milky Way. Rather than pull out all the stops on the much anticipated 'ride' portion of the film, the visual effects teams opted to proceed with caution. "We had to convey the possibility that all of this took place only within Ellie's mind," Debbie Denise related. "There were certain rules. We would only reveal what was outside the pod from Ellie's POV or looking over her shoulder. If the camera shot her face, we would see nothing extraordinary behind her. That was consistent with Bob's intent."

The pod shudders, its interior ablaze with shifting colors, as Ellie is treated to stellar vistas flashing by through now transparent facets of the pod wall. "One aspect to the ride strongly differentiating it from *Stargate* and *2001* was the amount of time spent with the camera on Ellie," observed CG supervisor Ron Brinkmann. "Her moods and expressions are in response to the vistas she is seeing, and her reactions as a human being to these incredible sights are the principal focus of the scene. Good science fiction should be about people, with the technology and gimmicks serving only as a backdrop to the story – not the other way around."

Like the Zoltan Kodaly hand signals corresponding to the music tones in *Close Encounters of the Third Kind*, spiritual symbols were used in *Contact* to illuminate the transdimensional passage. "Ellie's

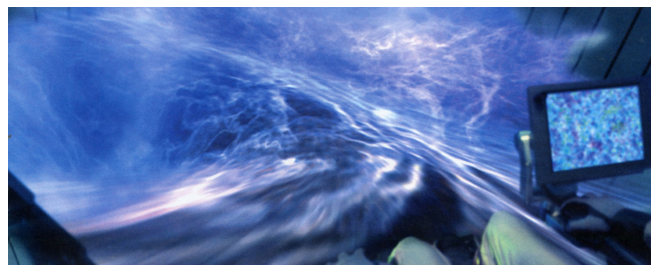


On a bluescreen stage, Jodie Foster is strapped into the pod's passenger seat for live-action closeups as the capsule is sucked into an energy vortex that launches it across the far reaches of the universe. Air mortars directed at the actress' face simulate the effects of G-force distortion on her features.

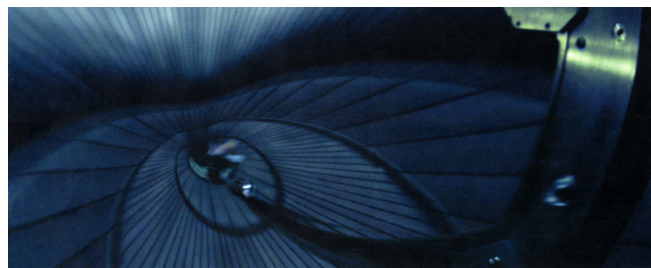
enlightening experience has a pseudochakra feel,” explained Steve Rosenbaum. “We discussed this at length before shooting even started; and I came up with a color scheme progression based on the seven chakras, which take you through the spectrum of the rainbow. Journey’s end culminates with Ellie bathed in a golden-orange light, which in spiritual terms signaled the presence of the crown chakra and her attainment of an enlightened state.” The chakra lighting scheme was adopted by main unit director of photography Don Burgess, as well, and would serve as a guide for the many interactive lighting cues on the pod interior set.

In addition to the colorful stage practicals, additional lighting effects, of a decidedly fanciful type, were suggested by the script. Supplied with a live-action plate of Foster in the pod, Industrial Light & Magic created a ‘ghost face’ image which took on a life – and voice – of its own as it squirmed away from the actress. “Originally we thought that these were going to be our most difficult shots,” ILM visual effects supervisor Jim Mitchell admitted, “because I figured we’d have to get into some elaborate layering of 3-D Dynamation effects to make the ghost face look like it was swimming around in space while remaining attached to Jodie. I worked with Pablo Helman, our Sabre artist, to come up with a look as a guideline for the 3-D effects; but the images he was coming up with using 2-D techniques were so cool-looking in their own right that we just went with those. Pablo utilized the movement of Jodie’s head to create a sort of ‘video feedback’ element that was mixed with other lighting effects. The final touch was a frame-by-frame painting of fleshy streaks between the real face and the ghost face. It added a kind of erratic, violent quality that Ken and Bob liked. Ultimately, these shots came together quickly once we locked into this rippling imagery.”

Now in interstellar space, the pod passes through a stellar accretion disk – a vast cloud of gas and debris swirling around Vega. “Ken trusted us to develop the look of the accretion disk on our own,” stated Mitchell. While the production had provided storyboards and animatics, it fell to ILM technical directors Joel Aron and Gregor Lakner, along with art director Alex Jaeger and Mitchell himself, to work up the look of the deep-space phenomena. “We wound up creating a large digital model of the disk, based partly on scientific information and partly on what we thought looked good and satisfied production’s requirements for velocity, motion and mass. “It took a while to create a sufficiently dense group of clouds and debris using geometry and Dynamation particles. Everything was backlit by a cool blue light to imply the younger Vegan star – as opposed to our sun, which is an older star.”



Looking down past her feet, Ellie glimpses the energy vortex, visible through the now transparent wall of the pod. The CG effect was developed by Weta using a custom volumetric renderer. Subsequent ‘podvision’ shots – revealing the interior pod and views of the intergalactic vistas beyond – were entirely computer generated by Weta.



In a visceral manifestation of the pod’s warp-speed descent through a series of tunnel-like wormholes, Weta animated another POV revealing the capsule walls stretching into the elongated shape of the tunnel, then snapping back again.

Low-rez iterations suggested that, like Jay Redd's opening pullback, the accretion disk would benefit from slower movement to imply enormity of scale. As a result, the shots grew in length, requiring even more detail to sustain them under prolonged scrutiny. "*The ghost* shots were only seventy to one hundred frames, so we weren't slowed down by those; but with the accretion disk on screen for so long, we really had to get it perfect." Shots of the disk were sent on to Weta for incorporation into pod window and over-the-shoulder foregrounds.

Film director Peter Jackson – owner of Weta – acted as a creative liaison between SPI, Zemeckis, and his own firm for the fifty-odd subcontracted shots, with Charlie McClellan acting as effects producer. The first wormhole vortex into which the pod is drawn was realized at Weta by Gray Horsfield, utilizing a custom volumetric renderer developed by Richard Addison-Wood. "While most of our work on this show was done using Wave-front's Dynamation and Explore software – together with previously developed in-house code – in the case of the wormhole, we needed variable opacity to procedurally create dimension through depth-cueing and transparency," explained Horsfield. "There were three shots planned for the first wormhole, all of which ultimately ended up joined together as one extended shot." The combining of shots came about after a Weta animatic test of the wormhole – evocative of Niagara Falls – caught Zemeckis' eye and suggested that Ellie would observe matter preceding her into the wormhole before she herself was drawn in. Essentially, her first glimpse of the wormhole became a sustained view as her pod slowly approaches and then is drawn rapidly down into the space-warping funnel.

"We only had about three and a half months to pull all of this together and deliver the completed shots," Addison-Wood remarked. "As a result, the volumetric renderer developed to produce the vortex was designed specifically to depict phenomena that were light-emissive rather than light-reactive. The full applications – for clouds and other light-reactive forms that occur more readily in nature than wormholes – will be possible once we've developed the system further." While most renderers deal in surfaces, this system allowed the artist to select areas of a given shape, then animate textures both atop and within the object, while varying the density of the volume.

Even before plunging into the wormhole, Ellie sees signs of extraordinary influences at work on the pod, in the form of a prismatic rippling of its solid floor permitting a distorted view of the ocean through it. The effect was developed at SPI by technical director Amelia Chenworth and Mark Holmes. "As the rings spin faster," said Steve Rosenbaum, "Bob wanted to create a transparency effect on the pod driven by the rings sweeping past the bottom of the pod – a clever way to open a portal for Ellie, and the audience, to view her galactic journey."

While the conceptual looks for both the floor window effect and a similar wall effect – dubbed 'podvision' – were developed at SPI, Weta digital artist Matt Aitken would produce the actual shots featured during the ride sequence. "I began with a watery kind of wavering motion," commented Aitken, "then, over the course of about forty passes, evolved it into more of a spindly-fingered look. We utilized the pod superstructure as a framing device for most podvision shots. It gave us a middle distance between the pod wall and these incredible vistas, which really helped sell the idea that this wormhole is way out there, instead of just beyond the pod wall. It also provided a surface that cast shadows and allowed for reflections and interactive lighting from the fast-moving phenomena outside."

Variations on podvision were created for different velocities. “It wasn’t so much a matter of finding a look that Ken and Bob would approve,” said Aitken, “as it was finding one that could be controlled so as to produce varied effects, given the different speeds and environments we were passing through.” For fast-moving shots, when the pod was whipping along through the wormhole, elements outside were reflected in a distorted manner by the pod window, so the image twanged before snapping back. But in shots where the pod was either stationary or moving slowly, a different look was required. “We went rather soft and shimmery there. The feel is organic and pulsing, like a heartbeat – suggesting that Ellie is tensely awaiting the next part of her journey. We also had to create custom transitions for a couple of shots where the pod starts to accelerate, then slows after a wormhole passage. We couldn’t just dissolve between the slow and fast effect, so we animated a progression based on the specific elements visible outside.”

Other work by Aitken involved enhancing and cleaning up the main unit photography. “The interior pod set was probably just a half-sphere. As a result, there were a few shots looking past Ellie in which grips and all sorts of odds and ends were visible in the backgrounds. At first we were just going to create a bit of digital pod, sampled from the set, to fill out these backgrounds. Then it became clear that we would be better off creating a complete pod interior for those shots.” The CG interior was employed in a number of shots throughout the sequence. “Bob and Ken had always wanted the pod interior – since it is of extraterrestrial design – to have an otherworldly sheen to it. Our virtual pod was able to reflect that sensibility.”

A startling effects enhancement to the sequence – dubbed ‘spaghettification’ by SPI – demonstrated visually what might happen if one were sucked into a black hole. Weta artists John Sheils and Wayne Stables created the effect, seen as Ellie enters each wormhole, stretching the pod walls spatially across the entire screen in the span of just a few frames – a visceral variation of the rubber-band-snapping *Star Trek* warp-drive. “In concept, this was a simple effect,” related Sheils. “What made it difficult was reconciling all the constraints placed upon us. For example, although we had to stretch the pod, we were not allowed to distort Ellie or her chair; and yet she had to stay anchored to the pod ceiling. Also, when the pod was extremely stretched, it still had to be recognizable, even though it was just a pattern of streaks. The bluescreen plates of Ellie needed extensive cleanup and retiming to fit the final animation. It became a delicate balancing act that ultimately produced some pretty dynamic shots.”

Ellie’s passage through the third wormhole is a bumpy one. Digital artist Buckley Collum enhanced Allan Hall’s first-unit physical effects through wholly digital means. “Individual sections of the pod walls were supposed to be vibrating – each at different frequencies,” said Collum. “Achieving this practically would have required building an elastic pod; so, instead, it fell to us. After isolating the various tiles in the set, we animated these myriad vibrations in high-resolution for a few hundred frames. It was a fairly subtle effect that very few people will notice because of what’s going on in the foreground.” Vibrations in the chair to which Ellie is strapped were also intensified for this portion of the passage. “That required cutting the imagery right out of the production footage and pasting it back in with moves added. Sometimes we isolated the chair from Ellie and at other times we cut them both out, depending on the camera move.” Inside the third wormhole, the pod’s zero-gravity environment becomes evident as a toy compass on a chain – a memento that Ellie has carried with her from Arecibo – floats up out of her pocket. “That was a CG effect. Ellie grabs at it as

it floats in front of her, so there's all sorts of shadow interaction going on, plus racking in and out of focus on the compass."

As Ellie's ride ends, she finds herself transported well beyond Vega into an idyllic beach setting with a sky full of stars that might be glimpsed near the galactic core. "Intellectually, the thought was that this beach would have a heightened reality," commented Ken Ralston, "one that might make the everyday world seem like a vague dream by comparison. From an effects point of view, the challenge was to convey that concept visually. In a film that keeps topping itself, there is always the danger of going too far. You want to take the audience to the next level without crossing the credibility line." The heightened-reality beach would prove to be among the most difficult elements in the film to conceptualize. "Bob didn't want the beach to look completely real," related Debbie Denise, "but a virtual reality approach wouldn't have worked either. It had to have a kind of dreamlike quality – hence the strange, 'wrong' elements, such as ocean waves running in reverse – to keep the question alive as to whether any of it was real."

Digital cinematography would be the key to achieving Zemeckis' vision. "In my mind," remarked Ron Brinkmann, "this is the first completely successful attempt to create a fluid synthetic environment. This could be the way future movies are made. No more faking alien planets by shooting at Vasquez Rocks. No limitations placed on the director. Just shoot your actors on blue, then find the background you like."

The first shot in the sequence typified the challenging, but problematic approach demanded by Zemeckis, who selected Fiji as the basis for the enhanced beach environment. "Ellie descends from the sky, which forms from a glint in her own eye," Ralston stated. "As she touches down, the environment comes up behind her and the camera does a 360-degree sweep around her to show the beach. It was all done backwards – we shot the beach first, then tiled that together with a fantasy sky that interacts reflectively with the water." A video animatic of the scene, shot at Malibu before plate photography began, enabled the digital team to see how the whole sequence might evolve editorially.

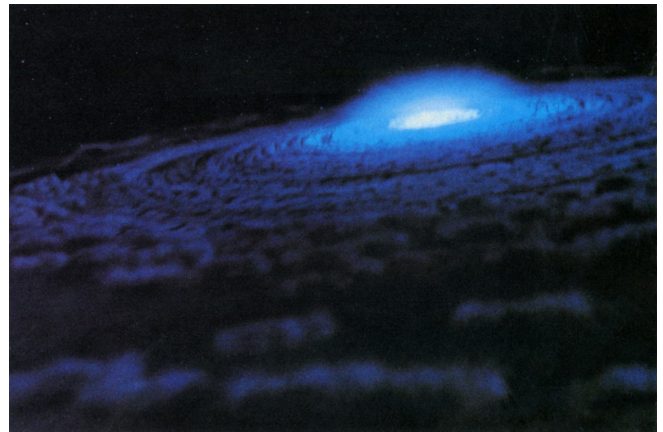
A small crew headed by Ralston shot film plates that would be digitally seamed together as tiles for the full field of view. "Others have done this," Brinkmann acknowledged, "but in most of those cases the backgrounds were pretty static – just a step up from 3-D matte painting. In this instance, we had waves crashing onto the shore and palm trees swaying in the breeze, so we had to keep those elements from overlapping tiles." In essence, the scene consisted of a multiplane mosaic, with fully rendered individual layers – a tree layer, a beach layer, a water layer, a sky layer, a nebula layer, even a galaxy layer for certain shots. "The tiled elements were not out at infinity – they were specific distances away. And those distances would change depending on how we moved the camera – which in turn affected parallax and perspective."

In filming Jodie Foster for insertion into the scene, Zemeckis had stood the actress on a blue turntable – or, in several instances, strapped her to a blue teeterboard – in front of a large bluescreen. “Bob’s bluescreen shoot with Jodie was done with all sorts of different lenses,” noted Brinkmann, “while the Fiji plates were shot only with 35mm or 50mm lenses. We built our three-dimensional environment from the plates, mimicking the beach in separate layers of depth. To get the foregrounds and backgrounds so they’d work together spatially, we back-projected – sort of ‘unprotected’ – the plates with a virtual lens to normalize the view, then reprojected them with the proper perspective plugged in. There were a lot of factors to consider – and even if the approach worked, we weren’t sure what to expect – but when we saw the first test composites, everyone was surprised at how well the illusion was sustained.” The stylized, unreal nature of the sequence was not the help Brinkmann had hoped it would be. “We had to replace the entire sky, doing roto and chroma-key to drop it out. The bottom line was that the technical problems had to be solved first – and even then there were limitations. For instance, the camera could only move down the beach for a limited distance before the background stopped working. So you couldn’t follow a horse for a continuous shot in this environment – not yet, anyway.”

Sequence supervisor Sam Richards developed software tools to accomplish the tiling. Seventy-five different tiles were used for the full 360-degree background – and in some shots, nearly all were visible. Compositing of the various tile elements was handled by CG sequence supervisor Bart Giovannetti, who, with Sheena Duggal, also supervised the compositing of the foreground characters over this synthetic background. Duggal, co-supervisor of high-speed compositing, used Inferno to fashion a myriad of fine animated details aiding the subtle dovetailing of foreground and background. “Determining which elements of unreality to include was an issue,” stated Duggal. “The palm tree shadows swaying with sped-up motion and the ocean tide running backwards had to be okayed. Then, of course, there were technical matters, such as resolving Jodie’s fine blonde hair, making color corrections, and setting focal lengths which tied her into the backgrounds. The theoretical depth of field meant, in some instances, that we had to go in and defocus particular slivers of elements – usually edges on Jodie. While her face stayed sharp, the



During the pod’s violent passage through the vortex, a ghostlike, distorted extension of Ellie’s face takes on an apparent life of its own. Industrial Light & Magic employed 2-D image processing for the effect, utilizing the movement of Jodie Foster’s head to create a video feedback element enhanced by lighting effects.



Approaching its destination, the pod passes through a dense cloud of swirling gas and debris, known astronomically as an accretion disk. ILM created the stellar phenomenon with digital geometry and particle systems, basing the look of the cloud on both scientific reference and aesthetic considerations. Slow-moving animation helped to imply enormity of scale.

blonde hair and back of her head needed softening to simulate what we would have achieved if we'd been shooting with this particular viewpoint on a real set with a shallow depth of field."



At the culmination of her journey, Ellie finds herself on a surreal beach under a canopy of stars. SPI produced sweeping views of the setting – combining bluescreen photography of the actress with multi-layered CG effects and an off-kilter background assembled by seaming together tiled segments of location plate photography to create a full and versatile digital environment.



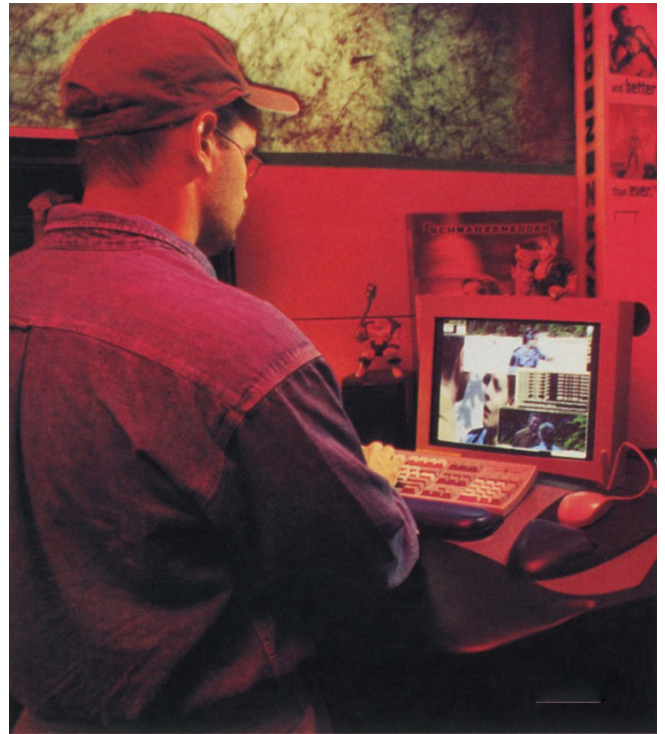
Robert Zemeckis briefs actor David Morse and Jodie Foster on a bluescreen stage for a scene in which Ellie is visited by an extraterrestrial in the guise of her long-deceased father.

Such softened highlights – suggesting a scene filmed with diffusion – obviously could not be produced with bluescreen. “We created our bloomed highlights against the matte element of the actress,” Duggal continued, “then mixed them back into the final comp at varying levels, depending on the theoretical focal length of a given shot. Flickering highlights from star reflections on the water were added to the reflective mix of lighting playing across Jodie’s eyes. The combination of softness, reflected highlights from the background tiles, and motion blur was, like so much else in the film, very subtle, giving the frame a prettiness resembling what you might get by placing a stocking across the lens on location.” One minuscule element of reality was nearly removed. “There was some redness in her eye, so we were going to take it out until Bob decided that space travel is hard on people – the redness stayed in.”

While on the beach, a figure appears to Ellie in the form of her long-deceased father (David Morse). In speaking with him, Ellie discovers that she is, in fact, communicating with the alien intelligence that summoned her. Soon after, she finds herself back in the pod, plummeting down into a catch basin beneath the machine – a shot achieved with miniatures. The rough-and-ready look of the pod retrieval net was again a deliberate attempt to contrast well-established modern technology with the seemingly inexplicable oddities of an alien one. “We purposely went low-tech,” Phil Notaro recalled, “fashioning it along the lines of an aircraft carrier’s emergency landing retrieval system. The nets were elastic and motion controlled through pulls so we could vary the rate of stretch, thus suggesting heavier and lighter impacts.”

For the pod’s splashdown, another quarter-scale model was built by Notaro and his Thunderstone team. “That one was a stunt pod with little detail – just a sphere with the twelve-sided superstructure roll bar surrounding it – which we shot highspeed at a tank facility in Acton. We attached three long pieces of bungee cord and stretched them out before fixing them to our crane model. When they let go, it accelerated the stunt pod toward the ground, causing it to hit the water really hard-which gave us a terrific splash. Then we lowered the hero pod into the water slowly on a separate take.” The splash element generated by the stunt pod’s plunge was subsequently laid over the hero pod’s descent and impact.

To Ellie’s astonishment, no time has passed on earth during her journey into the cosmos; and for all the watching world, the pod seems simply to have plummeted 1600 feet into the ocean. With no evidence to support the story, Ellie’s account of an intergalactic voyage is discounted by some, believed by others. But for Ellie, the impact of the experience has been profound. Sustained by the knowledge that she is not alone, Ellie is seen, in the film’s conclusion, lecturing a new generation of students before a newly constructed super array – the physical embodiment of her continuing quest



Technical designer Matt Farell adds refinements to the complex synthetic environment created for the sequence.

for knowledge. ILM provided the crucial location element. “We added about thirty CG dishes to the New Mexico VLA to create the new array,” explained Jim Mitchell. “Matte artists Paul Huston and Bill Mather initially laid out the dishes and some construction equipment on a static frame of each shot. Then compositors Tim Alexander, Grant McGlashan and Chad Taylor split the image into about four or five layers that could be tracked to the different parts of the ground. Atmospheric haze was also added to the dishes receding toward the horizon.”

Toward the end of postproduction, one-hundred-hour work weeks were the norm at Sony Pictures Imageworks as the last five dozen shots, both in-house and from other vendors, flooded the pipeline. Despite the proximity of SPI to the production, based at nearby Culver Studios, the assignment had been a globe-trotting one for the effects team – and a grueling one. “There were always different countries to visit for more background plates,” remarked Ralston. “I went from Florida to Los Angeles to Fiji, then New Zealand and Newfoundland, on to Washington and New Mexico, then back to Florida and Washington. New Mexico was a string of twenty-hour days, with rain and hail plaguing us throughout.” Later on, the time crunch generated by the increasing shot load would further test the endurance of all involved. “I hate the crunch, but it does force us to push our art further and further. And new techniques and technologies free up the director to be more creative cinematically – quite a change from the old days, when effects guys would tell a filmmaker to chain the camera down if he wanted a shot to work.”

Midway through the production, on December 20, 1996, Carl Sagan, who two years earlier had been diagnosed with cancer, would succumb to the disease – mere months shy of *Contact*’s completion. In the week prior to the picture’s release, NASA administrator Daniel S. Goldin announced that the unmanned Pathfinder space probe – which had just made planetfall and was about to commence operations on the surface of Mars – would be renamed the Carl Sagan Memorial Station. Perhaps equally buoying to the renowned astronomer’s memory is the thought-provoking and contemplative film he helped to create – a triumph of technology and a tribute to his lifelong fascination with the mysteries and wonders of the cosmos.

Contact photographs copyright © 1997 by Warner Brothers. All rights reserved. Production still photography by Francois Duhamel. SPI still photography by Jim Britt and Michael Middleton. ILM still photography by Sean Casey and David Owen. Additional images courtesy of Composite Image Systems and Weta. Special thanks to Don Levy, James Finch, James Steach, Charlie McClellan, Marie Davis, Ellen Pasternack, Jeff Walker, Janie Russell and Jess Garcia.

SPEED 2

CRUISING SPEED

article by Ellen Wolff

Choosing high seas terrorism as the milieu for the sequel to his enormously successful directorial debut, *Speed*, Jan De Bont has offered up *Speed 2: Cruise Control*, a daredevil popcorn movie that opens with a breakneck chase and, by the time it is done, has turned a Caribbean cruise ship into a massive, town-destroying battering ram. Based on a story created by De Bont and Randall McCormick, the director's latest thrill ride for Twentieth Century Fox once again centers on the character of Annie Porter (Sandra Bullock), *Speed*'s ditzy but courageous passenger-turned-bus-driver.

Speed 2 finds Annie embarking upon a Caribbean cruise aboard the *Seabourn Legend* with her boyfriend Alex Shaw (Jason Patric), a member of the Los Angeles police department's SWAT team. The couple's vacation plans are shattered, however, when the cruise ship is commandeered by John Geiger (Willem Dafoe), a terminally ill computer wizard and disgruntled ex-employee of the company responsible for designing the vessel's automated navigational system. Overriding the system, Geiger programs the ship to *Speed* forward, setting a collision course with an oil supertanker after he has absconded with onboard valuables, spurring Alex and Annie into action to save themselves and their fellow passengers.

Like its predecessor, *Speed 2* would be realized through a mix of physical and visual effects, this time with an emphasis on computer generated imagery. No fan of miniatures, De Bont was determined to film most of the movie's fantastic action sequences live and in full-scale; but even the on-set physical effects, orchestrated by special effects supervisor Al Di Sarro, would be enhanced digitally, while many shots would be created almost entirely in CG. The digital slate was divided between Industrial Light & Magic, which created 86 effects shots for three sequences, and Rhythm & Hues, where 41 effects shots were produced.

ILM visual effects supervisor Stefen Fangmeier, an Oscar nominee for his work on De Bont's second picture, *Twister*, headed the ILM team. "The shots in *Speed 2* that required digital effects were pretty clear cut," Fangmeier noted. "Working on *Twister*, Jan had learned what was feasible to do with CG; so we agreed very quickly on what things he would do for real and what we would add on. The attitude was, "Go out there, shoot what you can to make it look as dramatic as possible, and then we'll put in the finishing touches."

Exemplifying this approach was a sequence in which Alex is pulled dangerously close to the ship's propeller as he attempts to slow the Speeding vessel by jamming large nautical ropes into it. Underwater plates for the 33-shot sequence were filmed by Pete Romano, under the supervision of Rhythm & Hues visual effects supervisor Bert Terreri. "We photographed Jason Patric in a series of cuts to make it appear as though he were being sucked towards the propeller," said Terreri. "But, obviously, we couldn't really film a moving ship's propeller or put an actor in its proximity. Our mandate from Jan was to imply threat and velocity and, at the same time,



In the Jan De Bont film, *Speed 2*, Rhythm & Hues added a CG propeller to underwater shots of Alex Shaw (Jason Patric) trying to stop a Speeding out-of-control cruise ship by jamming its prop.

make sure we could see the actor.” To ensure that the threat was strictly implied, rather than actual, Patric was filmed swimming beneath a propeller-less barge bottom that represented the cruise ship’s hull. “The underside of the barge was art-directed to look like the underwater portion of the last twenty to thirty percent of the ship, with all the struts and shafts in place.” A sense of accelerated velocity was tougher to achieve since the barge was towed by tugboats moving at only one and a half knots to enable both Patric and Romano to perform their respective underwater tasks safely. “Even at that relatively slow *Speed*, it was somewhat treacherous.”

In the story, Alex is being fed the larger hauser rope from a winch device on board the cruise ship. Lacking such a winch system, the effects team improvised a way to make the rope look as if it were being fed to Jason Patric during the filming of the plates. “The hauser rope weighed about ten pounds per foot,” said Terreri, “so we needed a fairly heavy-duty setup to deal with it. We wound up rigging a pulley system by attaching the rope to the axle of a rented Toyota and driving the car up and down the barge, as needed. We probably tied well over a thousand pounds of rope to that car’s back axle. It was a great way to create a winch.”

Once the underwater plates had been filmed, computer animated propellers were tracked to the barge and composited into the shots. For reference, Terreri’s team shot underwater footage of the *Seabourn Legend* with its propellers engaged. “Oddly enough,” Terreri stated, “it was pretty quiet under there. There was an eight-foot propeller spinning, but because it was in deep water – about eighteen feet – it didn’t look like much. It was actually dangerous, and you could feel yourself being pulled towards it; but visually, it wasn’t very stimulating.” The digital team heightened the tension of the sequence in its execution of the computer animated propeller. “We animated the propeller and a hub system, put the propellers on a shaft and added motion blur. To make it appear more threatening, the propeller was animated to turn in towards the actor, rather than away from him. That meant that the blades were actually turning the wrong way – which definitely violated the laws of physics.” Some shots required not only the computer generated propeller, but also a larger keel – a digital addition requested by De Bont after the plate photography had been filmed.

The hand-held camera work that has become De Bont’s signature added a degree of difficulty to the sequence, especially when it came to tracking the CG propeller and keel to the barge in the plate. “There’s really no such thing as 3-D tracking software,” explained Terreri, “so we had to hand-track everything. We ended up testing the tracking for each shot maybe forty times before we matched



For shots of the cruise ship approaching and glancing off a giant supertanker, Industrial Light & Magic inserted a CG ship – with digital water interaction – into film plates of a real tanker.



For shots of the cruise ship approaching and glancing off a giant supertanker, Industrial Light & Magic inserted a CG ship – with digital water interaction – into film plates of a real tanker.

exactly what the camera was doing. On top of that, there were about twenty shots with Jason Patric; and for each of those, we had to lift the actor off the water, along with his breathing apparatus and exhaust bubbles, then attach the CG keel and propeller to the barge, and then put the actor and his bubbles back in, adding CG bubbles that integrated with his own bubbles. It was a lot of effort, and it took weeks.”

Due to the difficulties involved in tracking the underwater footage, in some cases Terreri opted to replace the barge bottom with a CG boat. “Originally,” Terreri related, “we were going to add our propellers just to the raw plates. But when we were underwater, I realized that this was going to be a tracking nightmare, in part because the currents were so bad – both Pete and Jason were getting beat up down there. So I determined that we could alleviate the tracking problem in some shots by putting in a boat bottom that was entirely CG.”

Computer generated ropes were animated to wrap around the propeller. Finally, digital bubbles surrounding the propellers and Patric – critical to suggesting the *Speed* of the runaway ship – were added, providing a finishing touch to the sequence, “We grouped small bubbles together to create the illusion of velocity,” stated Terreri, “layering them behind Jason, coming off the propellers and in the foreground.” Generated by a program that is part of Rhythm & Hues’ proprietary Propane software, the CG bubbles could be assigned specific sources, proportions, velocities, gravity and rates of decay. “The technical director created a generator, which was like having a digital bubble machine – it was the source of the bubbles and generated them from a particular position, such as in front of each blade of the propeller. Then we assigned velocities to the bubbles, based on the rotational axis of the propeller. So, depending on whether it was up to *Speed* or slowing down, the bubbles were generated proportionally. We also assigned them gravity and decay – determining how long they would stay in existence – as well as velocity, which was heightened by adding motion blur. “Also assigned were a synthetic camera velocity – to make it appear as if the bubbles were trailing away – and several layers of lighting. “For each of the bubble elements, we generated a highlight side, a fill side, a back side, a front side and an outside glow – and all of those levels had to be tweaked as the bubbles got smaller or larger or changed direction.” Each frame of the sequence took up to three hours to generate, due to the multiple levels of detail and labor-intensive wire and rig removals. “We did a lot of wire removal to get rid of the cables that held the hauser rope, which were in every shot. And because these cables were in the water, moving around, they weren’t just rigid lines that we could easily erase. Each frame had to be retouched. We used Matador to do that, creating our mattes with Elastic Reality software.”

The *Seabourn Legend* continues uncontrolled through open water – Alex’s heroics having failed to slow it – and barrels straight towards a supertanker filled with oil. Since it was not feasible for the real 470-foot *Seabourn Legend* to get close to the tanker, ILM built a computer generated model to stand in for the cruise ship for the near-crash and other sequences. One of the problems in building the computer model was that it would be cut in not only with footage of the real ship, but with stand-ins used for specific action sequences. “The real *Seabourn Legend* was rented for the production,” explained Fangmeier, “and it was in a lot of the movie. But there was also what they called the ‘bridge ship,’ which was a replica of the front quarter of the *Seabourn Legend*, built on a barge that could work in shallower water. The bridge ship also helped to cut down on the amount of time production had to use the real ship. Finally, there was a smaller version that was mounted on

a rail track, enabling them to get shots of the ship coming up on land at the end of the movie. So we had these three different versions of the ship. Since we did not want to have to build three different computer models to match each of them, we built the CG ship to match the real hero boat; and then, later on, in terms of scaling, we could just make adjustments for the other two ships as needed.”

The final CG ship was a densely detailed model, replete with hundreds of reflective windows and other details. “Enormous effort went into all the details of building that model,” related associate visual effects supervisor Roger Guyett. “There were a lot of man-hours involved in making sure that we had the right glints on the right windows at the right times. Modelers Larry Tan and Frank Gravatt did an incredible job of building the ship, with viewpainter Tony Sommers meticulously adding stuff like fire alarm buttons and warning signs on the decks. Since shots of the CG model would be intercut with images of the real *Seabourn Legend*, it needed to have that level of detail. Otherwise it would have been too clean, too neutral.”

“There were some shots where the ship passed right by camera in bright sunlight,” Fangmeier remarked, “which was a tremendous struggle. Part of the problem was that it was fairly plain – just a big white boat with a couple of blue stripes on it. But the subtleties are what make something look real. It’s easy to make gross brush strokes and say, ‘Here’s the ship and here are some reflections in the window.’ But to go in and finesse it subtly until it looks absolutely real is much more difficult. I had worked on the dinosaurs for *Jurassic Park*, and you would think that dinosaurs would be so much harder to get to look right than this boat; but lighting this big



ILM modeler Larry Tan at work on the intricate computer generated cruise ship model.

white thing and making it look interesting and real, rather than like plastic or a CG model, was very challenging. Also, this model was very large in terms of dimensions, even inside the computer, but it had some very small, detailed elements on it, such as a little lamp on deck. So we had to render the model at a high enough quality to make the small details look good; and yet, because the model was so big, that level of rendering became a very complex problem. Our lighting artists had to stretch Renderman to its limit.”

The ship’s *Speed* in the water was determined by the dynamics of each particular shot. “How fast the boat was moving was always an issue,” stated Fangmeier. “Our animators could give it an absolute *Speed*, of course, knowing how fast it would travel; but then, for every camera angle, we would get a different impression of that. There’s a reality that you can define, and then there’s a reality from the camera’s point of view – which is the only one that matters in a film. You can go at these problems with a lot of logic; but ultimately you learn that, in this business, the only thing that’s important is how it looks to the camera and how it plays in a sequence. As long as it works for the shot, it’s amazing the extent of discontinuity, in terms of logic, that you can get away with.”

For some shots, ILM not only provided the full ship via computer graphics, but also the surrounding water interaction. “We had shots where we just filmed still water,” Fangmeier recalled, “then put our computer model in there and created the interaction of the bow wake and turbulence behind the ship. Our CG artists didn’t recreate an actual water surface, but they did add white, foamy elements using particles – limited geometry with complex shaders to create the appearance of white, turbulent water.” Dynamation’s particle system software provided the framework for the interactive water elements. “Within Dynamation, we had already written a tremendous amount of code for the work in *Twister*. Dynamation gave us the interface, but it was up to us to determine how the particles would move and how the person using the system would interact with it. We created menus and had people spending quite a lot of time getting the tool to that level. We also created our own renderer so that we could render these particles in conjunction with Renderman. That way, a Renderman object – like the boat, for instance – could cast a shadow onto the particles, and vice versa, so we could get integration.

At the end, we could take the Renderman element and the particle element, motion-blur them together and composite them, knowing they would all be integrated in the final image. The investment we made in this software area during *Twister* paid off well for the work in *Speed 2*.”

In addition to creating wakes behind the CG ship, particle elements were employed for shots of water spraying upwards as the vessel strikes a glancing blow off the side of the tanker. Control was crucial, since De Bont wanted the water sprays to react in a very specific manner. “Jan wanted a plume of water at a certain time to cover a certain distance,” Guyett said, “and some of those things are a bit difficult to control with particle systems. Hans Uhlig did a lot of the animation on that. It was really a methodical process.” The water effects were refined through 2-D processing. “We would render various layers of spray and water splashing; and then our lead compositor, Scott Frankel, would go in using 2-D techniques and improve upon what we could get out of the basic render.” Digital sparks were also generated to sell the illusion of a metal-on-metal impact. “Jan wanted to see smoke coming off the ships as they grated along, almost as if this was causing a little fire. We had smoke coming from the stacks of the *Seabourn Legend* and sparks and bits of tanker flying off into the air – all digital.” As the cruise ship finally clears the tanker, De Bont reveals the damage from a sweeping aerial point of view in which we see the CG *Seabourn Legend* with a gouged and battered hull, courtesy of ILM viewpainter Tony Sommers.



Shots of the ship smashing into a seaport and coming to rest were achieved by propelling a practical bow piece through full-size breakaway sets and extending it with the digital ship.



Shots of the ship smashing into a seaport and coming to rest were achieved by propelling a practical bow piece through full-size breakaway sets and extending it with the digital ship.

For a moment it appears that the ship has narrowly escaped disaster; but, of course, the reprieve is only temporary. The passengers of the *Seabourn Legend* soon discover that the vessel is on a highSpeed and unalterable trajectory into the center of a Caribbean coastal town. Just before making landfall, the craft steams into the island's busy, boat-filled harbor. While De Bont would have preferred to shoot the entire harbor approach sequence with the actual *Seabourn Legend*, other solutions had to be found, since the harbor waters on location at St. Martin were too shallow to accommodate the full-size ship. Mounted on a flat barge that could maneuver in shallow waters, the bridge ship was convincing enough for De Bont to get closeups of actual collisions with pleasure boats, even though the false bridge did not exactly match the dimensions of its authentic counterpart.

Medium shots revealing more than the ship's nose, however, called for a CG model, inserted into clean harbor plates. "The only thing we retained from the plate that would have been created by the bridge ship was its wake," said Sean Schur, another *Twister* alumni and the CG supervisor for the harbor approach sequence. "There were shots from the side where we absolutely had to replace the whole thing, such as one in which a water skier rams into the side of the boat." ILM had modeled the CG ship to the scale of the actual *Seabourn Legend*; but because it was digital, it could be manipulated as needed. "Sometimes Jan would say, 'It doesn't look menacing enough.' So we'd say, 'Okay, here's the ship at one and a half times its normal size.' There were a lot of different sizes in this one sequence. Whatever worked for an individual shot was what we did."

De Bont's goal was to make the audience feel dwarfed by the presence of the *Seabourn Legend* as it plows through the battalion of small boats. "In the middle of the sequence," Schur explained, "there are a couple of divers who are being dropped off by a dingy. They're facing in towards the harbor, away from where the ship is coming. When they turn around and see it, they dive underwater, the camera goes down with them, and the boat goes overhead. That was all done in one shot. Obviously, it would have been impossible without a CG boat. From the time you see the bow of the ship bearing down on the divers, the ship and bow wake are all CG. As the POV goes underwater, everything – the water, the bubbles, the ship – is CG. There were a lot of bubbles created by the divers themselves, but those bubbles weren't going to interact with the hull of the ship, since there was no ship filmed with the divers; so we faded off the real bubbles in the plate and interspersed CG bubbles, which bounced off the CG hull as it came toward us." Dynamation software was employed to produce the bubbles. To enhance the sense of realism, Schur also added particulate matter. Finishing touches, such as light playing off the particles, conveyed both atmosphere and depth.

The collisions and near-misses of the harbor approach sequence are mere preludes to the film's finale – a head-on crash that sends the *Seabourn Legend* tearing through the middle of the seaport town. To produce real, live-action havoc, the production rammed a false bow – mounted to railroad tracks laid under the town set – into full-size set pieces. "Jan likes the freedom of really being out there, filming these very dynamic camera movements," Fangmeier suggested. "For the crashes, he had twelve cameras rolling and he was sort of editing the sequence in his head – 'I need this camera angle and that one and that one.' He's been doing this for so long, he just goes out there, places the camera and creates a sequence on the spot, rather than taking a more staged approach. That's his style. For the harbor crash, he knew that having it actually happen live, with people

running from a real boat, he'd get more of a sense of reality and scale. So even though we knew we were going to replace the rail ship with a CG model, it was something there for people to react to. There was always that sense of wondering if it was going to stop in time or not, waiting for the take when it would just keep on going and everybody would have to scramble. That never happened, and the rail ship worked perfectly – but that very real anxiety was there, and you can see it as people are running in the foreground, turning around and looking at this huge ship coming.”

As in the harbor approach, the crash-into-town shots that revealed more than just the ship's bow were realized with a computer model. “We had to add about ninety percent of the boat digitally,” said Fangmeier, “because the bow was only about seventy-five feet of a 450-foot ship. So we extended the bow whenever you saw anything of the decks, or even anything more than just that small fraction of the ship. The most difficult part of it was matching up those two elements, combining our digital model with the live-action bow piece, which was vibrating and jiggling like crazy. We either had to replace the bow entirely, which we did in a number of shots, or try to line up our CG model section with the bow. What made that even more difficult was that the dimensions of the practical bow were completely off – the real *Seabourn Legend* was sixty feet wide at that point, but the bow section was only forty feet wide. And whereas the real ship was only about twenty-seven feet tall at the bow, the rail ship stood thirty-five feet. So it was a real challenge to integrate our CG ship and still preserve a lot of the live-action. The trick for match-movers Jim Hagedorn and Michael Halsted was to get the size of the CG ship to reconcile with the size of the rail ship so that it could fit into the space between the buildings that had been cut by the rail ship.”

To capture multiple takes of the crash, the rail ship had been pushed repeatedly forward and back. The result was that, rather than sequential cuts in which the ocean recedes further and further into the background as the boat continues to crash its way inland, some takes featured a large expanse of water in front of the boat. And in some instances, the reapproaching boat was clearly ramming into buildings that had already been destroyed. “The boat couldn't go all the way through town at once,” Fangmeier related, “so they had to do it in stages. But that meant that in the second takes, the ship was traveling through an area that had already been demolished in the first take. So CG animator Dave Hanks added a lot of that stuff back in, filling in CG boards for the walkway and CG buildings to create the illusion that the cruise ship was coming through the area for the first time.”

Viewpainters had the daunting challenge of recreating all the successive layers of destruction on the *Seabourn Legend* as it makes impact with the town's structures. “To make it work in each successive shot,” Tony Sommers recalled, “we had something like six versions of the ship, each with added amounts of damage. The biggest challenge was keeping track of which version of painted damage was needed for each shot in order to maintain continuity throughout the harbor crash sequence.” Viewpainters and modelers were also charged with creating digital debris to enhance the practical effects. “Even I find it hard to believe that the pieces of wood flying through the air and floating in the water are digital.” The sequence also required very painstaking rotoscope work, due to fishing poles, lines, sailboat masts and light poles that dotted the background. Roto was further complicated by vibrations in the plates, caused by the jostling of the camera as the crowd of people on the wooden dock ran from the incoming craft.

The 'money' shot of the sequence has the *Seabourn Legend* demolishing a condo that lies in its path. "The rail ship was prepared to crash through the condo," recalled Fangmeier, "and the condo had been rigged with explosives to make the crash more dynamic. I was standing about three feet behind Jan when the boat started to move towards us. Two big explosions went off and there was debris flying everywhere – and Jan didn't move an inch. Everyone else was stepping back, but he just stood there, holding the camera. It was a classic Jan De Bont moment – it's what he lives for."

The *Seabourn Legend* finally comes to rest in the heart of the town, the scope of the mayhem revealed in a 515-frame aerial shot. But, of course, all does not end there. *Speed 2* concludes with Geiger's getaway plane being impaled on the mast of the supertanker. "The plane approaches the tanker and attempts to bank," explained Terreri, "but it is too close and the plane runs into the mast and explodes, which puts fire on the deck of the tanker and causes it to explode, as well." Because it was a quick two-cut scene, the action of the plane being caught by the mast was achieved with a computer generated plane model built by Rhythm & Hues. "You see the plane tilting on the mast; then there's a down-shot through the hole in the plane. We did that as a greenscreen element, actually climbing up the mast seventy feet in the air and shooting down from that angle to get our plate."

The scene also featured up-angles of the plane as it starts to explode, followed by a succession of explosions as the tanker goes up. "The exploding tanker sequence primarily involved doing a lot of hand-held photography," explained Terreri, "shooting plates of the tanker from a tugboat at various and sundry angles." Explosion elements that would be composited with the footage of the tanker were executed on dry land by Al Di Sarro and filmed at angles that would correspond to those in the plate photography. "Most of the plates were shot from Jason Patric's point of view in the water next to the tanker, which meant they were up-angles. But we couldn't find an area on the island that was high enough to set off the explosions and give us that appropriate angle. So we wound up building towers on an open beach, setting off the explosions on top of those towers, and filming from below. The angle wasn't exactly right, but it was close enough." The five-hundred-foot-tall gasoline explosions were captured by multiple cameras – anamorphic, Vistavision, some working at 36 frames per second, some at 48 – set up side by side.

Compositing the practical explosions believably with the tanker plate was the final challenge for Rhythm & Hues. "We built a very low-rez tanker in the computer so that Jan could gauge his cuts," stated Terreri. "Then we scanned the film into the computer and synthetically created the hand-



The villain's getaway plane crashes on the deck of the oil tanker, causing the enormous vessel to explode. Rhythm & Hues composited practical pyrotechnics and digital shrapnel into the shots.



The villain's getaway plane crashes on the deck of the oil tanker, causing the enormous vessel to explode. Rhythm & Hues composited practical pyrotechnics and digital shrapnel into the shots.

held camera angles. Jan wanted a series of six explosions, so we had to work our way down the tanker, sometimes altering the explosion *Speeds* or making other slight adjustments. Then we painted out the trees and sky that were in the shots. Probably five weeks of paint work went into just cleaning those up.” Final composites were sweetened with digitally produced shrapnel flying out from the explosions. “We built a few high-rez scraps, such as fuselage, pontoons, seats and miscellaneous debris to give the shots some volume, as well as a propeller coming towards the lens.”

The film’s final, true De Bont-style shot is an 850-frame aerial view of the island port, littered with masses of CG debris. After the rigorous and practical effects-heavy shoot wrapped, the effects work at Rhythm & Hues and ILM continued into the postproduction period. And although De Bont was much more in his element on location, standing with his camera amidst collapsing buildings and falling debris, the director remained very much at the helm. “Jan was incredibly involved all during postproduction,” Fangmeier stated. “In fact, he worked almost harder in post than he did in shooting. He worked seven days a week for three months to complete this movie. Jan is very much in tune with what we do. He had the confidence to use the post work as a tool; and, in dealing with the technology, he displayed a flexibility that was quite complementary. And because he stayed in control of the process, without just relinquishing it to us, everything in the film was really his choice.”

When *Speed 2* opened in June, little mention was made of its hundred-plus effects shots – but public indifference to the effects was what Terreri and Fangmeier had been going for all along. “The intent was to do something where the audience wouldn’t analyze the effects too much,” Fangmeier remarked. “On other projects I’ve worked on – like *Twister*, *Jurassic Park*, *Casper* and *T2* – the audience was pretty much aware of the special effects. But at least half of the shots in *Speed 2* were those that most people would never even think of as effects. This project was really more about a recreation of reality. Most people, not understanding how impossible it would have been to do some of these things with an actual cruise ship, look at sequences in this film and say: ‘Oh, that’s not an effect. They did that for real.’” As invisible as those effects may have been to lay audiences, they represented some of the most difficult film work Fangmeier had ever attempted. “Going into this movie, I didn’t think it would be as hard as it turned out to be. *Twister* was like a honeymoon; but *Speed 2* was like marriage – a lot harder than you think it will be.”

Speed 2: Cruise Control photographs copyright ©1997 by Twentieth Century Fox Film Corporation. All rights reserved. ILM still photography by Sean Casey. Additional images courtesy of Rhythm & Hues. Special thanks to Ellen Pasternack and Suzanne Datz.

JOHN CHAMBERS MAESTRO OF MAKEUP

article by Scott Essman

It has been more than a decade since John Chambers shut down his Burbank lab in favor of more sedentary pursuits, but his name still evokes admiration and respect among current luminaries in the field of special makeup effects. Widely recognized as one of the industry's earliest trailblazers, Chambers is credited with pioneering new makeup techniques and generally raising standards of technical mastery during his prolific thirty-year career as a makeup artist in television and film.

Chambers' Hollywood calling had its origins in the training he received as a dental technician while serving a three-year stint in the army during *World War II*. "I learned how to pull teeth and sculpt partial bridges," Chambers recalled. "After the war, I continued in the medical field, working for seven years at the Hines Veterans Hospital in Maywood, Illinois, a rehabilitation center for Korean War veterans." Called upon to fashion prosthetic limbs and body parts for injured patients at the center, Chambers was also given the job of casting body organs for anatomical research and restoration. "They'd send a fresh heart to me in a bucket of ice and want me to make a model of it. It was a great training ground – a key part of my education – but I knew that it wasn't going to be a lifelong vocation."

Instead, Chambers looked to the fledgling television industry as a more interesting outlet for his specialized skills. "I wrote a letter to NBC in Los Angeles, describing my techniques and the materials I used for sculpting," Chambers related. "I was fortunate in that a top man there wanted to learn lab work and offered me a job." Joining NBC in 1953, Chambers rose quickly through the television ranks, introducing innovations along the way. One such innovation – acquired from his days at Hines – was the use of dental stone as a casting medium. "In the fifties, a hundred pounds of plaster cost two dollars, and a hundred pounds of dental stone cost sixty. So everyone typically used plaster. But I introduced this very high-caliber, fast-setting material, which worked better." Initially assigned straight makeup work at the studio, Chambers soon found himself experimenting with Max Factor test makeup as NBC went from regional to national, and from black-and-white to color. Several years would pass, however, before the artist was able to overcome the closed-shop mentality of the makeup industry and concentrate on prosthetic work – his true area of interest and expertise. "The union made it difficult, but I was adamant. I knew NBC wanted me to do more advanced work, so I constantly fought with the establishment."

Eventually gaining access to the prosthetics lab, Chambers began putting his thorough medical knowledge of materials and techniques to good use. In one of his first assignments, he created character makeups for Pruneface, Flattop and others in an early television version of *Dick Tracy*. "John brought medical technology to television," stated makeup and creature artist Tom Burman. "He was a facial restoration technician as well as dental technician, so he knew how to make plastic laminate prosthetic eyes and the most gorgeous medical appliances. He brought technical skill to a field where most were artists or had learned their craft from plaster-shop people."



At the pinnacle of a thirty-year career in film and television, veteran makeup artist John Chambers accepts, from presenter Walter Matthau and friend, an Academy

Award for outstanding achievement in makeup for his work on Planet of the Apes.

After six years at NBC, Chambers moved on to Universal Studios, working in the makeup lab under department head Bud Westmore. In 1963, he created ten striking disguises for Kirk Douglas as well as makeups for Burt Lancaster and Frank Sinatra in *The List of Adrian Messenger* – his first widely recognized makeup success in film. A year later, he developed the key makeups for the monster comedy series, *The Munsters*. Assisting him on many of the projects was a young Michael Westmore, who, having come to Universal to apprentice for his uncle Bud, soon found himself under Chambers' tutelage. "There were no other lab technicians on the west coast with the knowledge that John had in prosthetic materials," acknowledged Westmore, now makeup supervisor for the *Star Trek* film and television franchise. "He made all of his dentures himself and taught me to do so. Because of John's teaching, I still make all my own dentures for the Ferengi and Klingons on *Star Trek*."

By the mid-sixties, after six years at Universal, Chambers' mastery of prosthetics and his superb craftsmanship had gained the attention of Hollywood. Gambling on his reputation, he launched a freelance business out of his Burbank home in a converted garage equipped as a full-service makeup lab. From there, John Chambers welcomed a steady stream of film and television producers from nearby studios, who called upon him to create everything from eye bags to noses to ears for a variety of projects. "It was an incredibly meticulous, well-organized operation," recalled sculptor Michael McCracken, who would later join Chambers in his garage setup during the seventies. "John fixed it up with linoleum flooring, grinding wheels and an oven. He gave off a strong feeling of confidence, so producers were very comfortable with him."

In 1965, a small side job that came to the shop was one that would eventually engender global recognition. "It was a petty thing," Chambers said, referring to the now universally recognized Spock ears he created for the Vulcan character in the original *Star Trek* television series. "Gene Roddenberry had approached me about doing the entire show, but I didn't take it because of a money dispute with Paramount. I did, however, cast Leonard Nimoy's ears and make all of the molds, sculptures and ear appliances for the first year of the series." Fourteen years later, those molds would serve as a guide for makeup artist Rick Stratton, assigned to the first *Star Trek* feature film. "We couldn't figure out how to do the three piece ear mold," Stratton recollected. "John had cast the ear in stone and sculpted the Vulcan ear tip on the cast. The tricky part was putting a seam on the backside of the ear and sliding in a third piece of the mold to retain the detail on the back. It was kind of tight due to lack of space behind the ear. Of course, once we saw how John did the process, it seemed easy."



*After several years in television, John Chambers joined the Universal Studios makeup department where, early on, he distinguished himself as the principal creator of the prosthetic makeups devised to disguise the all-star cast of *The List of Adrian Messenger*. Posing with some of the work produced for the film are department head Bud Westmore, and associates Michael Westmore, Chris Mueller Jr. and Chambers.*

The sixties would prove a profitable time for Chambers' fledgling venture. Among the television projects that came to the shop were such popular shows as *I Spy*, for which Chambers created a memorable Oriental appliance makeup for star Robert Culp; *Mission: Impossible*, which entailed a series of mask disguises for Martin Landau; and *The Outer Limits*, whose rapid production pace had the artist cranking out a monster every week. Television's minimal budget and scheduling constraints would ultimately foster Chambers' legendary knack for improvising makeshift characters on short notice. For a *Night Gallery* episode entitled *Pickman's Model*, calling for a monster who emerges from the Boston sewers, he fashioned a creature that, despite its low-budget origins, would become a cult classic and one of Chambers' personal favorites.

In 1966, Chambers collaborated with mask and prop maker Don Post Sr. on a twelve-foot-tall *King Kong* project for a wax museum in Ontario, Canada. "John knew my father from the fifties and early sixties," remarked Don Post Jr., owner of Don Post Studios, "when he would periodically help my dad make molds and finish sculptures if he was in a bind. The *King Kong* project also included artists Ellis Burman Sr. and Marcel Delgado, who sculpted the original creations for the 1933 version of *King Kong*. So it was quite an exciting time."

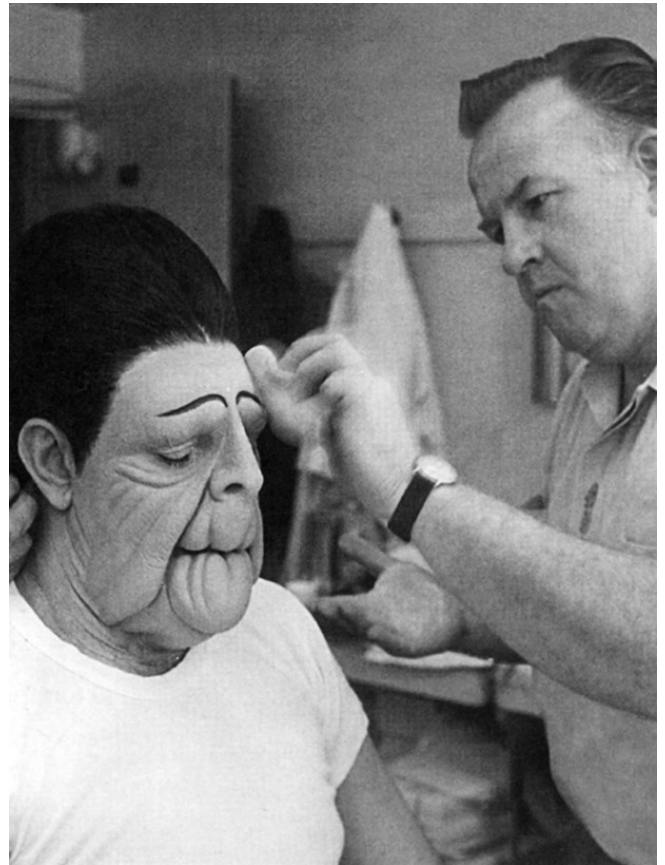
Later that same year, another assignment – arriving by way of Tom Burman, then a makeup apprentice at Twentieth Century Fox – would prove to be the definitive project of Chambers' career. "There was a big show coming," recalled Burman, "and department head Ben Nye was going to retire if they went ahead with it. Fox had done some extensive tests that didn't work, and I had heard that the producers wanted the man who had done *The List of Adrian Messenger*. So I spoke up, and said, 'The person who really innovated that work is John Chambers.' John picked up the screenplay; and the following Monday he came in, called me over and said, 'Tommy, you're with me on this – and I'm going to win an Academy Award.'"

In January 1967 – with makeup artist and close friend Dan Striepeke – Chambers began work on *Planet of the Apes*. Tasked with designing, creating and applying scores of convincing ape makeups for a cast of hundreds, Chambers would oversee a huge crew, delegating authority in the supportive manner that was to become his trademark. "I got the chance to dabble in everything," said Burman, who served as an apprentice on the picture. "I was awed to be working amongst all these journeymen, especially since I knew we were doing something memorable that had never been done before." One of Burman's first assignments was to sculpt the initial ape concepts. "The original sculptures were much more authentically apelike. Due to my lack of sculpting skills at the time, my later sculptures looked a little more humanoid. The producers saw them and eventually went in that direction." Under Chambers' guidance, Burman would learn many new methodologies – now standard practice in the makeup effects field. "I had to throw away everything I knew before *Apes*, because it was sloppy, plaster-making, prop-shop technique, and relearn, from the ground up, about foam latex, plastics and mold-making. John was fastidious, and these were practices that makeup artists, myself included, had no knowledge of then."

Anticipating the difficulties in transforming people into apes, Chambers was determined to use actors whose facial features would best compliment the simian makeups. "We sought actors with brown eyes and flat noses that would fit into the muzzle of the ape appliances," Chambers related. "Some of them were picked at random and their noses were too large. We found that we needed

physical actors, and they were usually among ethnic groups.” Concerned about the repercussions of casting apes along ethnic lines, the studio resisted Chambers’ approach. “In the very first tests,” Burman noted, “we had Filipinos for the chimpanzee characters, Chinese people for the orangutans and black men for the gorillas. But Fox was not going for that – it was the late sixties, and there was considerable racial unrest.” Characteristically uncompromising, Chambers eventually convinced the studio to put his original choices back into the cast.

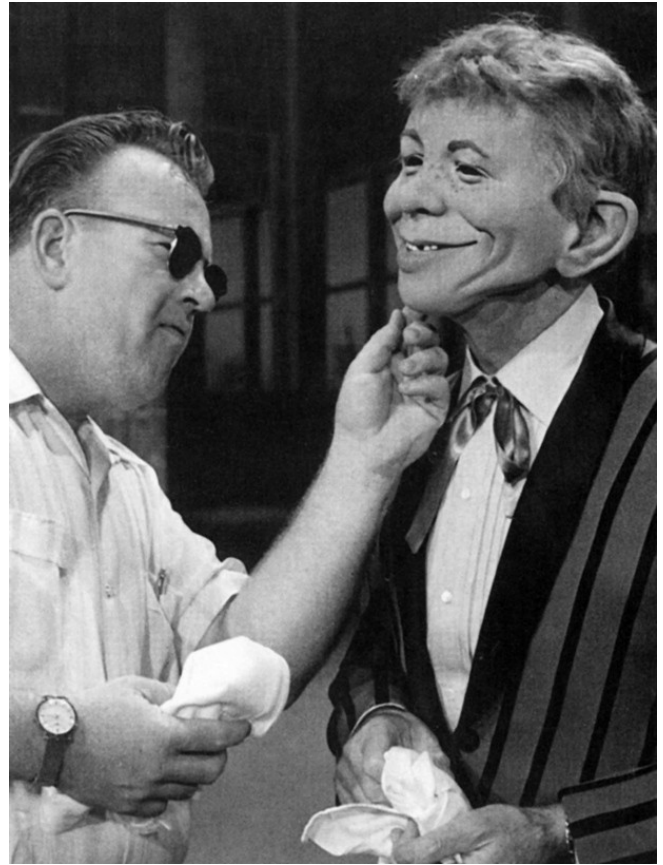
The artist’s resolve would also extend to casting decisions involving principal characters. Originally tested for the part of the orangutan leader, Dr. Zaius, Edward G. Robinson had his own makeup artist redesign the Zaius facial appliance with an unobstructed mouth to accommodate a breathing problem. Upon seeing the new makeup, Chambers objected vehemently. “I told the producers he had to wear the appliances we made so that he would fit in with the rest of the characters.” Though the artist and actor discussed possible compromise solutions, the issue could not be resolved, and the role was eventually recast. “I didn’t want it to come to that, but it couldn’t be helped. Word got back to me that *Robinson* later remarked that in his whole life, he had never met anyone who was as set in what he wanted to do as I was.”



Pruneface and other Dick Tracy characters were created by Chambers for an unfilmed television pilot.

Using an unprecedented approach to the makeup designs, Chambers fashioned facial prosthetics for the assorted characters using T-shaped, three-piece makeups – brow piece, upper lip and lower lip for chimps and orangutans, and two-piece appliances for the gorillas. The prosthetics, made out of an experimental foam rubber that allowed the actor's skin to breathe, would prove extraordinarily effective. "As I was testing the Apes appliances on the actors," recalled Howard Smit, a veteran of forty-five years as a makeup artist, whose first film assignment, in 1939, was making up the Munchkins for *The Wizard of Oz*, "I would chat with them and, after a time, forget that I was talking to a person. The appliances were that convincing. John Chambers was as brilliant an artist as I have ever worked with when it came to prosthetics."

Forced to meet the large-scale demands of the show, Chambers also pioneered new production techniques. One of the most innovative would entail prepainting the ape appliances. "That had never been done before," Chambers remarked, "and I was having trouble finding people capable of working within my system. Everyone I met with thought himself a fabulous artist; unfortunately, I couldn't afford to have Da Vinci and Michelangelo. I needed people who could do makeups that were uniform-looking." Seeking a flexible paint for the masks, he utilized acorn glue – a neoprene-based contact cement that he mixed with universal colors. Solvent was added to the glue to thin it down so that it could be airbrushed on.



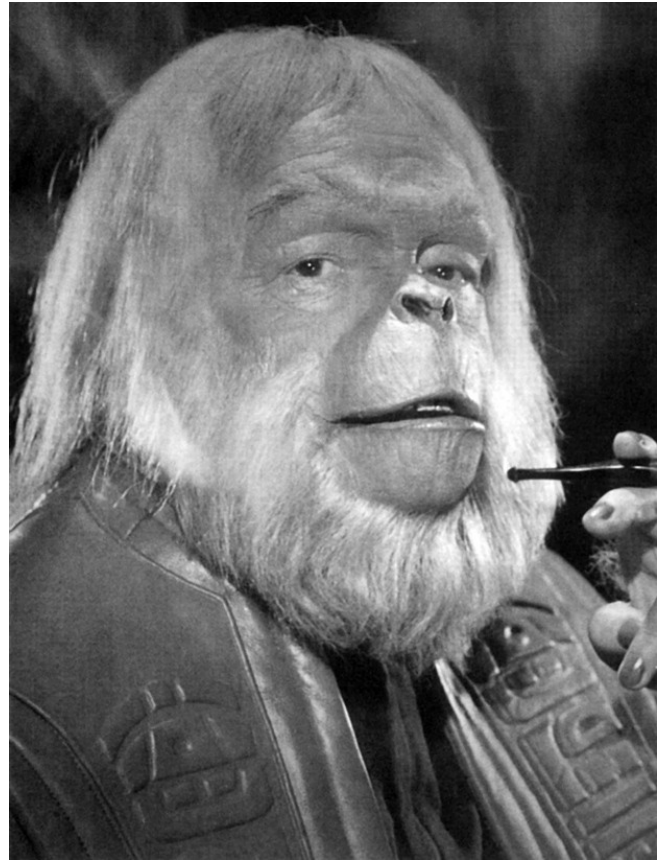
Chambers touches up an Alfred E. Neuman makeup worn by Fred Astaire during a dance number on a television variety show.



*In the biggest assignment of his career, Chambers created dozens of simian characters for *Planet of the Apes*. Kim Hunter and Roddy McDowall, as chimpanzee scientists, try to communicate with Charlton Heston.*

Equally innovative was the assembly-line approach Chambers employed in manufacturing the dozens of slip-rubber shell background masks that would be used in wide shots. "When we airbrushed with spray guns to paint the masks, we discovered that one artist could do the work of twenty. For appliances, after the foam rubber pieces came out of the mold, we put them on a vacuum-form support, then lined them up and airbrushed them one by one. At that point, they were ready to be fitted onto the actors' faces using a special spirit gum to attach them."

To help with the arduous task of making up the enormous cast of principals and extras during completion of principal photography, Chambers rounded up additional assistants and schooled them in prosthetic application. "We brought in people who were practically off the street," stated Burman, "and trained them for two weeks, ten to twelve hours a day." With as many as sixty makeup artists and forty hairdressers working on the set every day to accommodate a cast that included 160 extras with background masks, Chambers' systematized approach would prove a godsend. "Everything was laid out like paint-by-numbers – an appliance, a backup appliance, a vacuum form that the appliance would sit on, a base coat, a highlight and a shadow. We also had a hackle to lay hairpieces in, with the hair and wool all mixed and ready to go." At the end of each day's shoot, the prosthetics would be removed using an alcohol acetone solution that cut the glue and washed out the rubber without damaging it. "Out of practical necessity, the background masks were used over and over again. Usually they were assigned to a particular person; so by the end of the shoot they were pretty raunchy. Since we couldn't possibly keep up with all the appliances – when, on a daily basis, we were dealing with thirty-five to thirty-eight principal makeups – we would clean them in disinfectant, wash them in the acetone and alcohol, dry them, paint them, and then apply them on background principals or closeup background extras."



Maurice Evans as the ruling orangutan, Dr. Zaius.



James Gregory as a gorilla warrior in Beneath the Planet of the Apes, the first of four sequels to the original.

Released in 1968, *Planet of the Apes* was an unqualified success, prompting the studio to produce, in ensuing years, no less than four sequels and a television series, all of which kept the original makeup designs intact. “Werner Keppler supervised the makeups in all four of the film sequels,” remarked Chambers, “but I was there for three of them, assembling the molds and getting appliances ready.” For his pivotal work on the original, Chambers did not go unrecognized. At the Academy Awards ceremony that year, *Planet of the Apes* garnered a special Oscar for makeup effects, sharing the distinction with only one previous film, *7 Faces of Dr. Lao*. “They even had a chimp bring the Oscar out to me.”

In 1973, sculptor Michael McCracken and Dan Striepeke began collaborating with Chambers on a bizarre film called *Embryo*, starring Rock Hudson and Barbara Carrera. The picture required dozens of embryonic stages of humans and animals, plus several old-age makeups for Carrera. McCracken would continue his association with the garage shop during the next eight years through a variety of projects, including a 1976 adaptation of H.G. Wells’ classic story, *The Island of Dr. Moreau*.

To explore the original concepts for that film, Chambers had McCracken complete sketches and paintings; and on the basis of those ideas, producers changed the story to incorporate about ten new characters, representing Moreau’s misguided experiments in combining humans with animals. Included among these ‘humanimals’ were a bull-man, boarman and lionman. Since the project was too big for his garage studio, Chambers began working at the reopened Twentieth Century Fox makeup lab, in collaboration with Striepeke. Also joining the team was Tom Burman, who fashioned sculptures, molds and hair for the humanimal mutants. The makeup approach would differ significantly from the relatively simple hair appliances used on the man-beast mutants featured in the 1933 version of the story, *Island of Lost Souls*. Like *Planet of the Apes*, *Moreau* proved far more complex, with many makeups required.

During the seven-week location shoot in St. Croix, each humanimal actor required four hours of makeup application daily. “John was extremely conscientious about everything on the picture,” recalled McCracken. “Every day, he would arrive to make up a character at 4:30 a.m. It was as well coordinated an effort as any I have worked on – every aspect of it perfectly timed and budgeted. With John, there was never chaos.” Although the makeups were innovative, the movie – which had held great promise – did not live up to the artist’s expectations. “Near the end of the picture, I was disgusted with it,” Chambers admitted. “I told Michael York that I thought it would be a big flop.” His prediction would prove accurate when the movie – released in the summer of 1977 – bombed at the boxoffice.



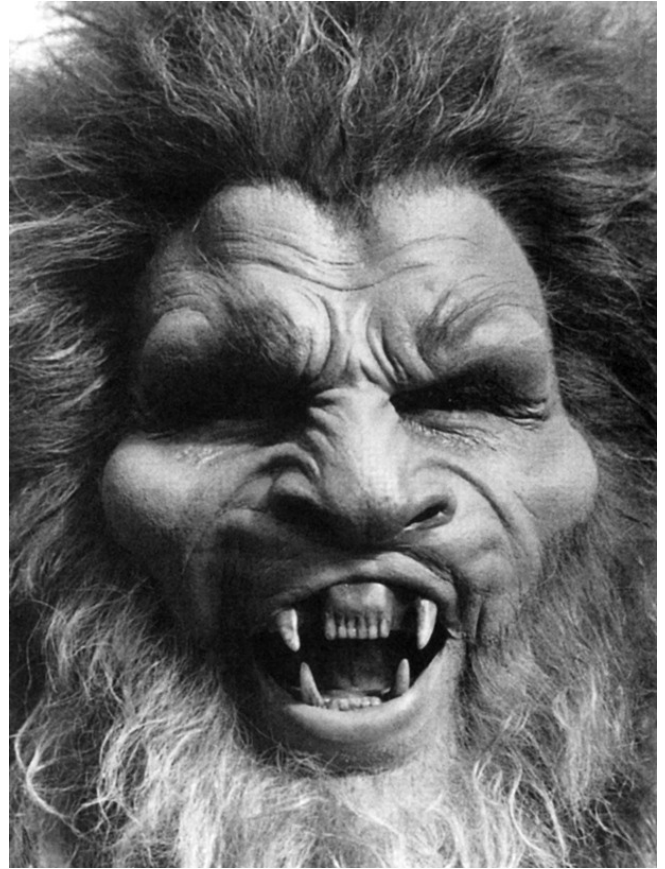
Among the many 'humanimals' created for The Island of Dr. Moreau, one of Chambers' last major projects, were a boarman and a lionman.

In 1981, Chambers recruited makeup artists Rick Stratton and Steve Neill to help him with an assignment for National Lampoon's Class Reunion involving a sequence satirizing popular horror films such as *An American Werewolf in London* and *The Exorcist*. While it was a first union gig for Stratton and Neill, the film would also be one of the last for Chambers. "For most of the jobs I had worked on," remarked Stratton, "there was never enough time or money to do things properly. With John, though, I saw somebody who took the time to do everything with great care. He regularly handled huge projects with the efficiency of a straight makeup artist. He was also very fair to his people. If he saw you going in the wrong direction without critically harming a project, he would allow you to screw up, and you learned from that."

Although much of his work did not make the final cut, Chambers' experience on *Class Reunion* would expose him to a whole new area of the rapidly evolving effects industry. "It was like a changing of the guard," stated Stratton. "We were using dummy heads and fiberglass cores and radio-controlled mechanical effects. It was the first time John saw this type of special makeup effect. He didn't understand all that articulated new stuff, but he was fascinated by it. The art that he had helped advance was being pushed even further by a new generation of artists."

Soon after the completion of *Class Reunion*, Chambers retired from active makeup work. Those who continue in the field, however, are quick to acknowledge his technical brilliance and willingness to share information. "Whenever I visited Hollywood from New York in the late fifties and sixties," remarked makeup legend Dick Smith, an esteemed mentor in his own right, "I learned some applicable innovation that Johnny had developed, like finding matting materials to add to adhesives, formulating soft plastics to make scars or finding better mold materials. I came to realize the importance of Johnny's search for better materials and techniques, and that has made an enormous difference in my work. Many other artists and I learned this from him; and it has led to a lot of the technical advances in the current era of makeup effects. We all owe him our respect and gratitude."

But Chambers' selflessness was not limited to sharing ideas and information with fellow professionals. Even during his busiest work period in the late sixties and seventies, Chambers generously encouraged newcomers to the field. "Although I was not an apprentice to John on *Planet of the Apes*," recalled makeup artist Ken Chase, "I got a lot of help from him, on a personal basis, as I



Among the many 'humanimals' created for *The Island of Dr. Moreau*, one of Chambers' last major projects, were a boarman and a lionman.

was teaching myself how to design and manufacture appliances for that film. Then he entrusted me with the daily application of Maurice Evans' Dr. Zaius makeup – which was a big responsibility.”

As an enthused fifteen-year-old, Tom Woodruff of Amalgamated Dynamics remembered being inspired by *Planet of the Apes* and a television series called *Primal Man* for which Chambers had created various stages of primitive man makeups. “I wrote to one of the performers on the show, and he sent me John’s address in California. For a kid from Pennsylvania, it was like the key to the Holy Grail. It took me days to compose a letter; and when I finally sent it, John answered right away.” Over the years, the two kept in touch, and when Woodruff finally traveled to California during a summer off from his studies, Chambers was instrumental in opening doors for the budding artist. “John sent me to Ken Chase one week, and the next he called up Stan Winston and got me an interview. He pretty much opened a lot of doors for me to go around with my portfolio.” Upon finishing school, Woodruff married and moved with his wife to California, where Chambers once again came to his aid. “He got me work with Tom Burman; and from there I was able to get in on *The Terminator* with Stan. Then things really took off.”

Others have attested to similar experiences. “When I was fourteen, I saw a sensational spread in *Life* magazine for *Planet of the Apes*, and wrote a fan letter to John at Fox studio,” remembered makeup effects artist Craig Reardon. “Not a week had gone by before I got a letter back from John inviting me to come to the studio lot. I thought I had met the greatest guy in the world.”

Filmmaker John Landis recalled a time when, as a mailboy at Fox during production of *Beneath the Planet of the Apes*, he would peek inside the makeup lab. “I know a makeup secret that only six people know,” revealed Landis. “There’s a famous piece of eight-millimeter film of Bigfoot walking in the woods that was touted as the real thing. It was just a suit, however, made by John for a David L. Wolper documentary.” Landis would later repay Chambers’ early hospitality when, as a young director in 1971, he cast the makeup artist as the National Guard captain in his low-budget feature film debut, *Schlock*. “He was very good. And I’m indebted to him because he sent me to Don Post Studios to develop the film’s gorilla suit. They, in turn, referred me to a twenty-year-old artist who had just visited there – and that was the start of my relationship with Rick Baker.”

From his early work in television’s crucial first decades through his groundbreaking cinematic triumph in *Planet of the Apes* and beyond, Chambers’ legacy of technical and aesthetic achievements has had an undeniable and lasting impact on the makeup community. “*Planet of the Apes* inspired us to reach for higher ground,” asserted celebrated creature creator Stan Winston. “In even attempting something on the scope of *Apes*, John pushed our whole industry forward and gave us the self-assurance that, with imagination and artistic taste, we could move beyond that which has been done before.”

For the seventy-five-year-old John Chambers – now residing at the Motion Picture Country Home in Woodland Hills, California – there is real satisfaction in seeing new barriers broken. “In the early days, we were hampered by strict rules, and there were many things we couldn’t touch,” Chambers reflected. “Fortunately, a lot of those taboos no longer exist, and there has been great progress by new artists. Having trained many of these people, when I see them creating fine things now, it makes me very proud. They’re doing fabulous work.”

Planet of the Apes photographs copyright ©1968, 1970 by Twentieth Century Fox Film Corporation. The Island of Dr. Moreau photographs copyright © 1977 by American International Pictures. Additional photographs courtesy of Michael Key, Bob Burns and Tom Burman.

THE NEUROTIC TENDENCY TOWARD PERFECTION PERVADES THE ENTIRE OFFICE. AS EVIDENCED BY THE COMPANY MASCOT.



DUCHESSE, OUR PATRON SAINT OF OBSESSION, DUTIFULLY DEMONSTRATES THE IMPORTANCE OF A TIDY WORK SPACE.

We, The Hypercritical at Blue Sky Studios, have come to believe two truths: 1) pathology is progressive and 2) retentiveness has its virtues. For us,

DETAIL OBSESSED = QUALITY POSSESSED

(i.e., righteous and godly CGI.) If you count yourself among our ilk, congratulations. We could be your kind of asylum.

WE ARE LOOKING FOR SOME AWESOME ANIMATORS, TD'S AND PROGRAMMERS. WHAT'S IN IT 4U? WELL, WHILE YOU'RE SENDING US YOUR REEL YOU CAN PONDER THESE ALLURING MOTIVES: CUTTING-EDGE TECHNOLOGY (most photo-realistic rendering software on the planet.) STAR CGI TALENT (for bios, check out our Web site.) DIVERSE PROJECTS (see below.) COMPETITIVE SALARIES. GROOVY WORK SPACE. AND THOSE EVER-POPULAR STOCK OPTIONS.



WHAT WE DO (WHEN WE'RE NOT WASHING OUR HANDS): first-class character animation and effects for feature films and commercials. Which ones? *REX's "Joe's Apartment"* (pictured at right), 25th Century Fox's "Alien Resurrection," Bubble Factory's "A Sample With," And plenty more coming down the proverbial TV line.



FOR REAMS OF OVERLY ORGANIZED MINUTIAE (OR PERHAPS JUST A LITTLE MORE INFO) EMAIL US AT: JOBS@BLUESKYSTUDIOS.COM.



ONE SOUTH ROAD HARRISON, NJ 07033
WWW.BLUESKYSTUDIOS.COM

CLASSIC OBSESSIVE/COMPULSIVES IN HISTORY



OEDIPUS: GREEK KING KILLED HIS FATHER OUT OF UNBIDEN LUST FOR HIS MOTHER.



NAPOLÉON: FRENCH EMPEROR DROVE HIS TROOPS TO THEIR DEATH IN VAIN PURSUIT OF WATERLOO.



WES: CREATIVE DIRECTOR. REFUSED TO SUBDUCE CURVED SURFACES ON PROFESSIONAL PRINCIPLE.